DRAFT

FIRST OPERABLE UNIT FEASIBILITY STUDY REPORT

FOR THE

SYOSSET LANDFILL
TOWN OF OYSTER BAY, NEW YORK

TOWN OF OYSTER BAY
1653
NEW YORK

PREPARED FOR:

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION II

REVISED JULY 1990

370959

TOWN OF OYSTER BAY
DEPARTMENT OF PUBLIC WORKS
150 MILLER PLACE
SYOSSET, NEW YORK 11791-5699

KARL J. LEUPOLD, P.E.
COMMISSIONER

(516) 921-7347

July 27, 1990

Carole Peterson, Chief
New York/Caribbean Compliance Branch
U.S. Environmental Protection Agency - Region II
26 Federal Plaza
New York, New York 10278

Dear Ms. Peterson:

RE: SYOSSET LANDFILL DRAFT FIRST OPERABLE UNIT
FEASIBILITY STUDY REPORT
CONTRACT NO. DPW 84-352R

In response to your letter of July 13, 1990, we have prepared responses to both USEPA and NYSDEC comments received regarding the Draft First Operable Unit (OUI) Feasibility Study (FS) Report for the Syosset Landfill. We have discussed these responses with Sherrel Henry of your office and enclose a copy for your review. We have revised the Draft FS Report accordingly and enclose fifteen copies for your distribution.

In addition, we have received the revised Endangerment Assessment (Versar - July, 1990) for the site and have reviewed it in regard to the comments contained in our letter of June 11, 1990. While the upper bound carcinogenic risk estimates have been revised and are similar to those reported by our consultants, which are within the USEPA acceptable range, we believe that these estimates along with the subchronic hazard index are substantially over-stated,and based on inappropriate assumptions regarding projected levels of groundwater contamination. These assumptions were discussed in detail in our letter of June 11, 1990 and include the use of a groundwater supply well which no longer exists, the use of unfiltered groundwater samples, the lack of model calibration and the consideration of all supply wells which are within a one mile radius of the site regardless of flow direction.

Although we have incorporated these risk estimates in the Draft OUI FS Report, we contend that the actual risks associated with the site are substantially less. This reduced risk estimates would be verified if proper assumptions were made during their development. Furthermore, since the Second Operable Unit (OU2) Remedial Investigation/Feasibility Study (RI/FS) process will identify off-site groundwater quality conditions, estimation of associated risks will be more appropriate during the OU2 RI/FS process.

Should you have any questions regarding this submission, please contact Richard W. Lenz, P.E. of this office.

Very truly yours,

KARL J. LEUPOLD, P.E.
COMMISSIONER/PUBLIC WORKS

KJL/JMB/RWL/ew

cc: Robert LoPresti, Director/Legislative Affairs
Anthony Maurino, Esq., Deputy Commissioner/Env. Ctl.
Peter Paden, Teitlebaum, Hiller, Rodman, Paden & Hibsher
John Lekstutis, Lockwood, Kessler & Bartlett, Inc.
Andy Barbar, Geraghty & Miller

DRAFT
FIRST OPERABLE UNIT
FEASIBILITY STUDY REPORT
FOR THE
SYOSSET LANDFILL, SYOSSET, NEW YORK

DRAFT

JULY 1990

Lockwood, Kessler & Bartlett, Inc.
One Aerial Way
Syosset, N.Y.

Geraghty & Miller, Inc.
Environmental Services
125 East Bethpage Road
Plainview, N.Y.

DRAFT
FIRST OPERABLE UNIT
FEASIBILITY STUDY REPORT
FOR THE
SYOSSET LANDFILL

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EXECUTIVE SUMMARY

In accordance with a directive from the USEPA, the Syosset Landfill site was separated into two operable units. The First Operable Unit was designated to address on-site remediation, while the Second Operable Unit will address off-site remediation. This First Operable Unit Feasibility Study has therefore been prepared to develop and evaluate on-site remedial action alternatives for the Syosset Landfill. The primary objective of the Feasibility Study process is to provide a detailed analysis of available remedial actions so that a preferred alternative may be chosen for the site. The remedial action alternatives developed herein are based on site characteristics identified in the Interim (on-site) Remedial Investigation Report for the Syosset Landfill (Geraghty & Miller, 1989) and potential risks associated with the site.

The remedial action alternatives evaluated in this Feasibility Study have been developed in accordance with the USEPA guidance document entitled "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (USEPA, 1988a). The alternative evaluation procedure described in the guidance document consists of three distinct steps: development of alternatives; screening of alternatives and detailed analysis of alternatives. The first phase of the evaluation process consists of combining available remedial technologies into remediation alternatives which meet the remedial action objectives. The second phase involves screening the remediation alternatives with respect to effectiveness, cost and implementability. The final phase of the feasibility study process provides a detailed analysis of the remediation alternatives that considers nine CERCLA evaluation criteria which include: the overall protection of human health and the environment, compliance with

ARAR's, long-term effectiveness, reduction of toxicity, mobility and volume of contamination, short-term effectiveness, cost effectiveness, community acceptance, state acceptance and implementability.

In general, alternatives which reduce toxicity, mobility or volume (i.e., treatment or removal technologies) are preferred over those alternatives which do not. However, at sites such as municipal landfills, the extremely large volume of low-concentrated wastes makes treatment or removal options impractical. Therefore, the remedial action alternatives presented in this First Operable Unit Feasibility Study include the No Action Alternative and landfill closure alternatives. The landfill closure alternatives consist of three containment alternatives.

The three closure alternatives involve the use of three different types of cap sections, including a low permeability soil (clay), a geosynthetic membrane and a low permeability asphalt cap. The two non-asphalt cap sections incorporate asphalt as a surface treatment to provide further cap efficiency and cap protection, while enhancing conformance with future site uses. Each of the closure alternatives have advantages and disadvantages. All of the capping alternatives meet the remedial action objectives. The low permeability soil (clay) cap provides the minimal potential for cap failure among the alternatives, but maintains a lower initial cap efficiency than the geosynthetic membrane, and has the highest capital costs of all the alternatives. The geosynthetic membrane cap provides the maximum initial cap efficiency but is susceptible to failure due to punctures or tears. The low permeability asphalt has the lowest capital cost but has the highest potential for failure (although failure points can be more easily identified and repaired in comparison to the other cap alternatives).

CONCLUSIONS AND RECOMMENDATIONS

Upon evaluation of the detailed analysis of the remedial action alternatives presented, Alternative 2B - geosynthetic membrane cap appears to be the most effective. Alternative 2B is protective of human health and the environment, complies with the ARAR's, is expected to maintain long-term effectiveness and provide minimal short-term impacts, is cost effective, and should be easily implemented.

The detailed analysis of alternatives also indicated that Alternative 2B appears to be the most protective alternative for human health and the environment, since it provides similar levels of protection for site surface soils and gas control as the other alternatives, and maintains the highest cap efficiency. This increased cap efficiency should provide the lowest amount of future leachate generation among the closure alternatives. In comparison to Alternative 2A (clay), Alternative 2B will provide less short-term impacts, maintain a higher degree of protection, will require less on-site excavation, is more cost effective and will be more easily implemented. In comparison to Alternative 2C (asphalt), Alternative 2B maintains a higher degree of protection, complies more strictly with the landfill closure ARAR's, is less susceptible to failure, is more administratively feasible, and is only slightly less cost effective.

SECTION 1

INTRODUCTION

Lockwood, Kessler & Bartlett, Inc. (LKB) and Geraghty & Miller, Inc. (G&M) prepared this First Operable Unit Feasibility Study (FS) Report under contract to the Town of Oyster Bay for the Syosset Landfill in accordance with the On-Site FS work plan (LKB & G&M, 1990) approved by the U.S. Environmental Protection Agency (USEPA) on April 6, 1990. According to the USEPA letter of approval of the Interim (on-site) Remedial Investigation Report for the Syosset Landfill (G&M, 1989), the site is separated into two operable units: the First Operable Unit which addresses on-site contamination, and the Second Operable Unit which will address off-site contamination. Therefore, the Interim RI Report constitutes the First Operable Unit RI Report and this document (on-site FS) constitutes the First Operable Unit FS.

1.1 PURPOSE AND ORGANIZATION OF REPORT

This report was prepared to develop and evaluate remedial alternatives to determine which measure will best ensure the protection of human health and the environment in a cost-effective and timely manner. The organization of this report is structured after the three phases of the FS process identified in the USEPA guidance document for conducting a RI/FS under the CERCLA (USEPA, 1988a): the development of alternatives; the screening of alternatives; and the detailed analysis of alternatives. The nine evaluation criteria set forth in the USEPA RI/FS guidance document were used in this report to form the basis for selecting appropriate remedial actions at the site. These criteria are as follows:

- o overall protection of human health and the environment
- o compliance with ARARs

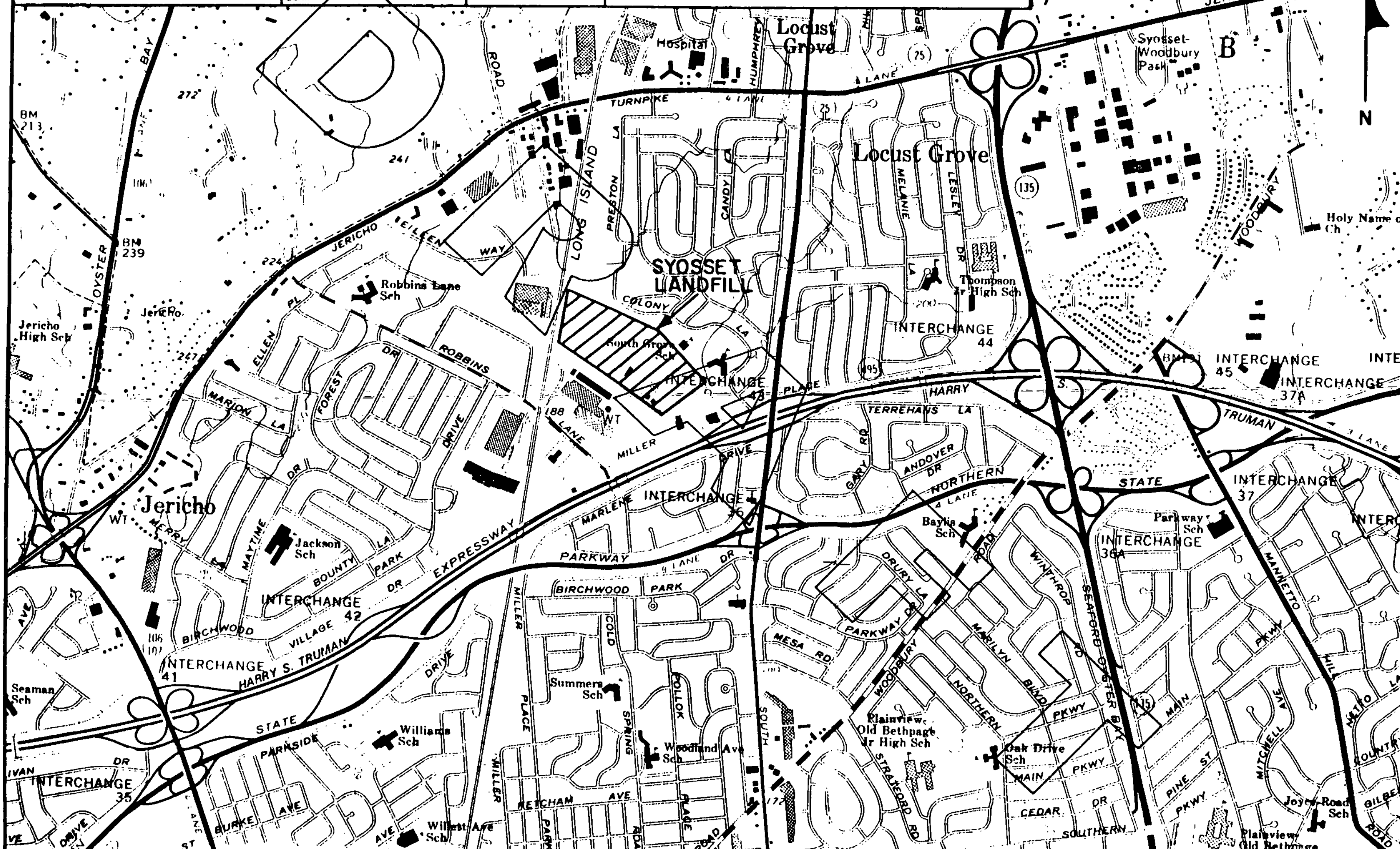
- o long-term effectiveness of the remedy
- o reduction of toxicity, mobility, or volume of the contamination
- o short-term effectiveness of the remedy
- o cost of the remedy
- o community acceptance of the remedy
- o state acceptance of the remedy
- o implementability of the remedy

1.2 SITE DESCRIPTION

The Syosset Landfill is located in central Nassau County in the Town of Oyster Bay, Syosset, New York (Figure 1-1). The site is roughly rectangular in shape and encompasses approximately 35 acres. The offices and facilities of the Town of Oyster Bay Department of Public Works (TOB-DPW) are located adjacent (east) to the landfill and occupy approximately 18 acres; together the landfill and the adjacent facilities total approximately 53 acres. Currently the Town of Oyster Bay (TOB) controls access to the site, which is fenced. Topographically, the site is relatively flat and at similar elevation to the surrounding area. The site is characterized by basically a barren landscape with some clumps of trees. Well locations, structures and other features at the site are shown on Figure 1-2. As illustrated in this figure, the site is bounded by the Long Island Expressway and Miller Place to the southeast, Cerro Wire & Cable Corporation to the southwest, and the Long Island Railroad to the northwest. A residential area and the South Grove Elementary School border the site to the northeast. The entire landfill area is enclosed by a 6-ft high cyclone fence.

GERAGHTY & MILLER, INC.
Ground-Water Consultants

COMPILED BY:	VINCE GLASSER	DATE: 10/88	SCALE: SHOWN	PREPARED FOR: LOCKWOOD, KESSLER & BARLETT, Syosset, New York
PREPARED BY:	ELAINE DeLUCA	FILE NO: N0340SL03-1115		
PROJECT MGR.:	VINCE GLASSER			



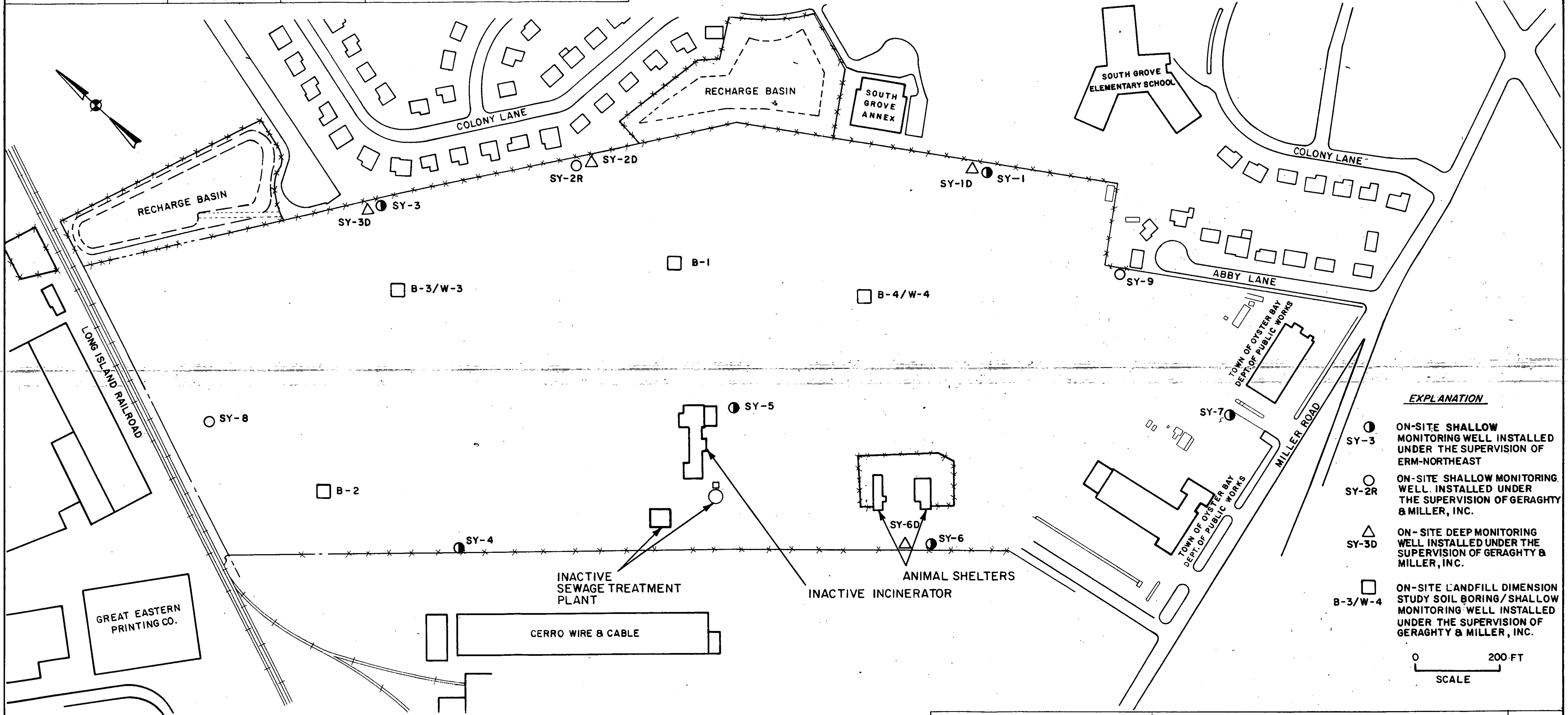
0 2000 FT
SCALE

SUBJECT: SITE LOCATION, Syosset Landfill, Syosset, New York

FIGURE 1-1

141881

GERAGHTY & MILLER, INC. Ground-Water Consultants	COMPILED BY: V.J.GLASSER	DATE: 10/88	SCALE: SHOWN	PREPARED FOR: LOCKWOOD, KESSLER & BARTLETT INC. Syosset, New York
	PREPARED BY: E. DeLUCA	FILE NO:		
	PROJECT MGR.: V.J. GLASSER	NY0340SL3-1115		



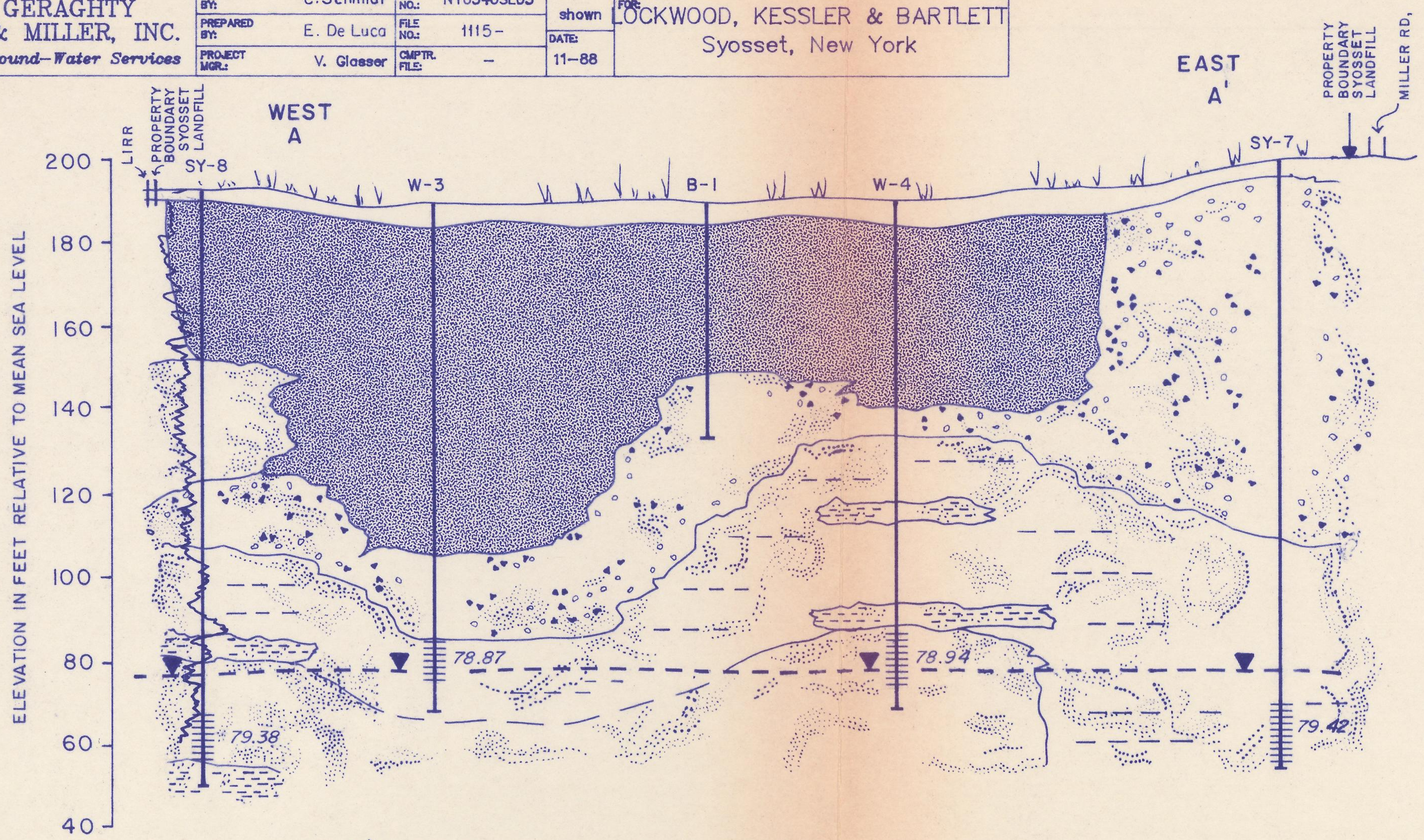
SOURCE: LOCKWOOD, KESSLER & BARTLETT, INC.
SYOSSET, NEW YORK

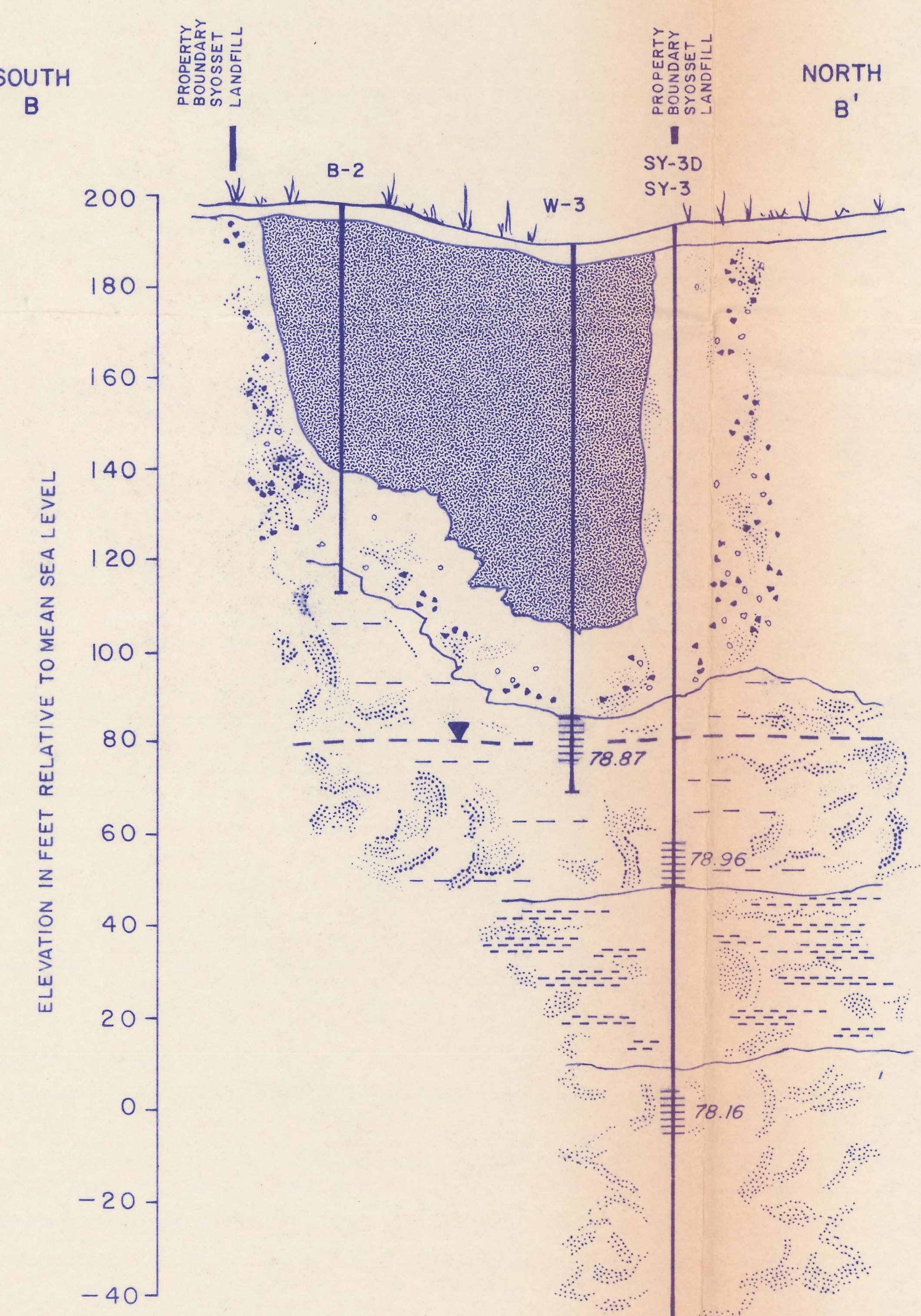
SUBJECT: LOCATIONS OF GROUND-WATER MONITORING WELLS AND SOIL BORINGS, Syosset Landfill, Syosset, New York

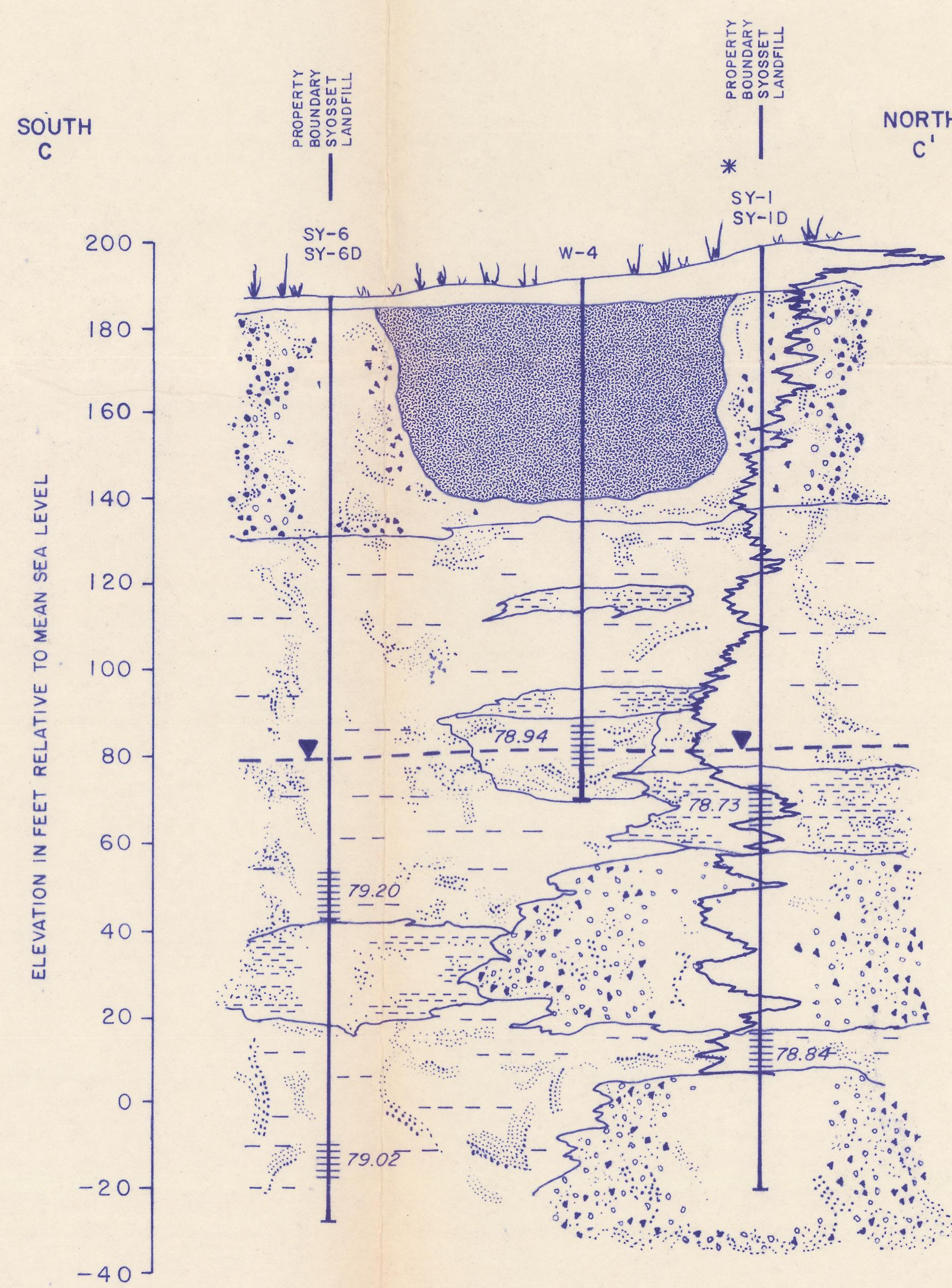
FIGURE 1-2

GERAGHTY & MILLER, INC.
Ground-Water Services

COMPILED BY:	C. Schmidt	PROJECT NO.:	NY0340SL03	SCALE:	shown	PREPARED FOR:
PREPARED BY:	E. De Luca	FILE NO.:	1115-	DATE:	11-88	LOCKWOOD, KESSLER & BARTLETT Syosset, New York
PROJECT MGR.:	V. Glasser	CMPTR. FILE:	--			







EXPLANATION

CLEAN FILL

LANDFILL

SAND, COARSE TO FINE WITH GRAVEL (WITH OR WITHOUT SILT).

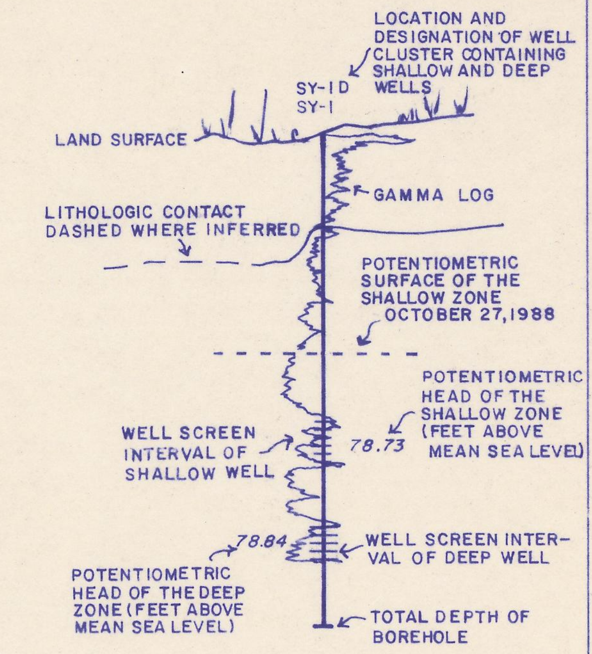
SAND, MEDIUM TO VERY FINE WITH CLAY STRINGERS (WITH OR WITHOUT SILT).

CLAY (WITH OR WITHOUT SAND AND/OR SILT).

SAND, MEDIUM TO VERY FINE WITH SILT

VERTICAL EXAGGERATION = 10X

0 400FT
HORIZONTAL SCALE

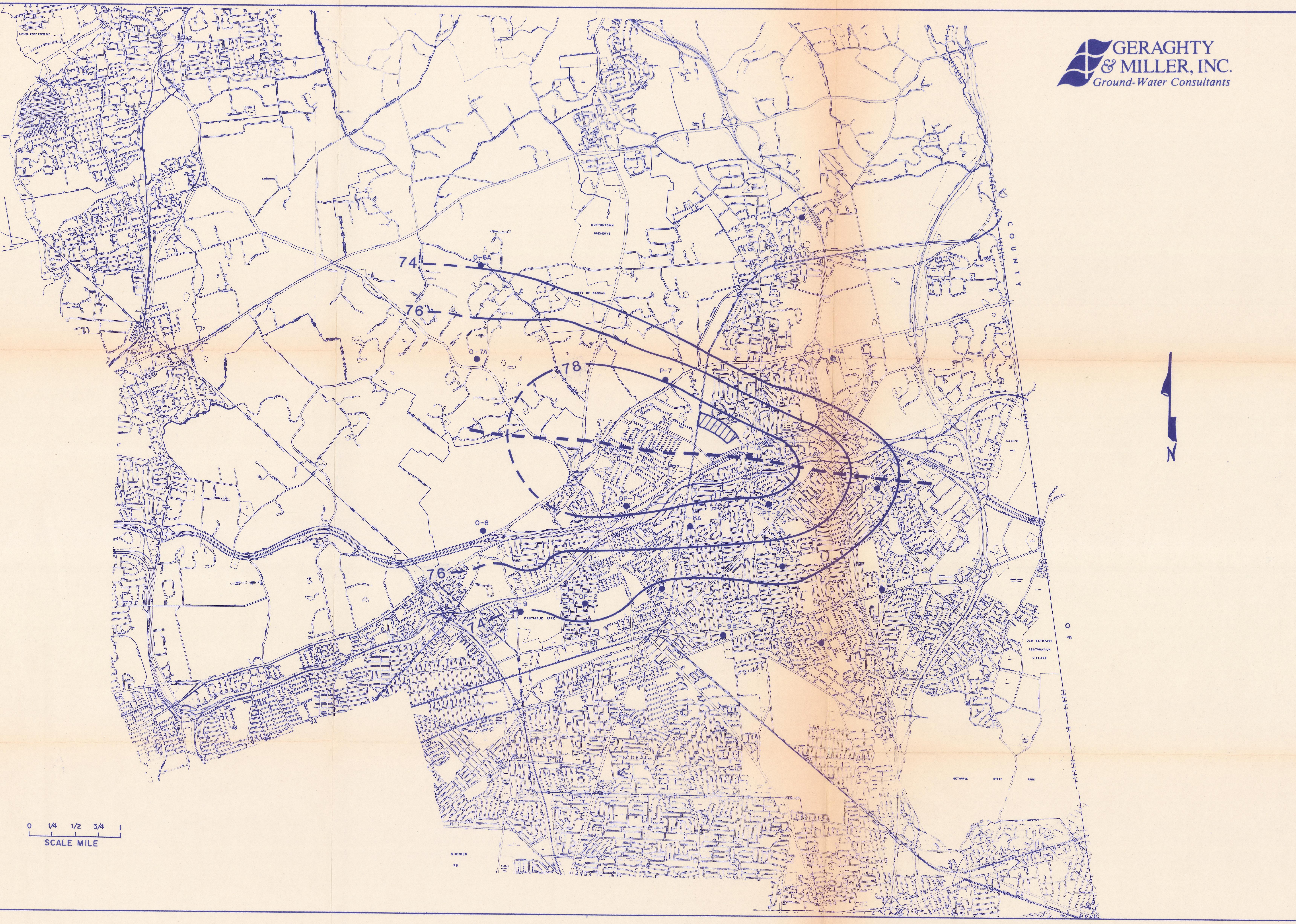


* GEOLOGIC LOGS FROM BOTH WELL BORINGS IN THE WELL CLUSTER WHERE TO ILLUSTRATE THE GEOLOGY.

SUBJECT:

HYDROGEOLOGIC CROSS SECTIONS A-A', B-B', C-C'
Syosset Landfill, Syosset, New York

FIGURE
1-3



EXPLANATION

T-8
● NASSAU COUNTY OBSERVATION WELL

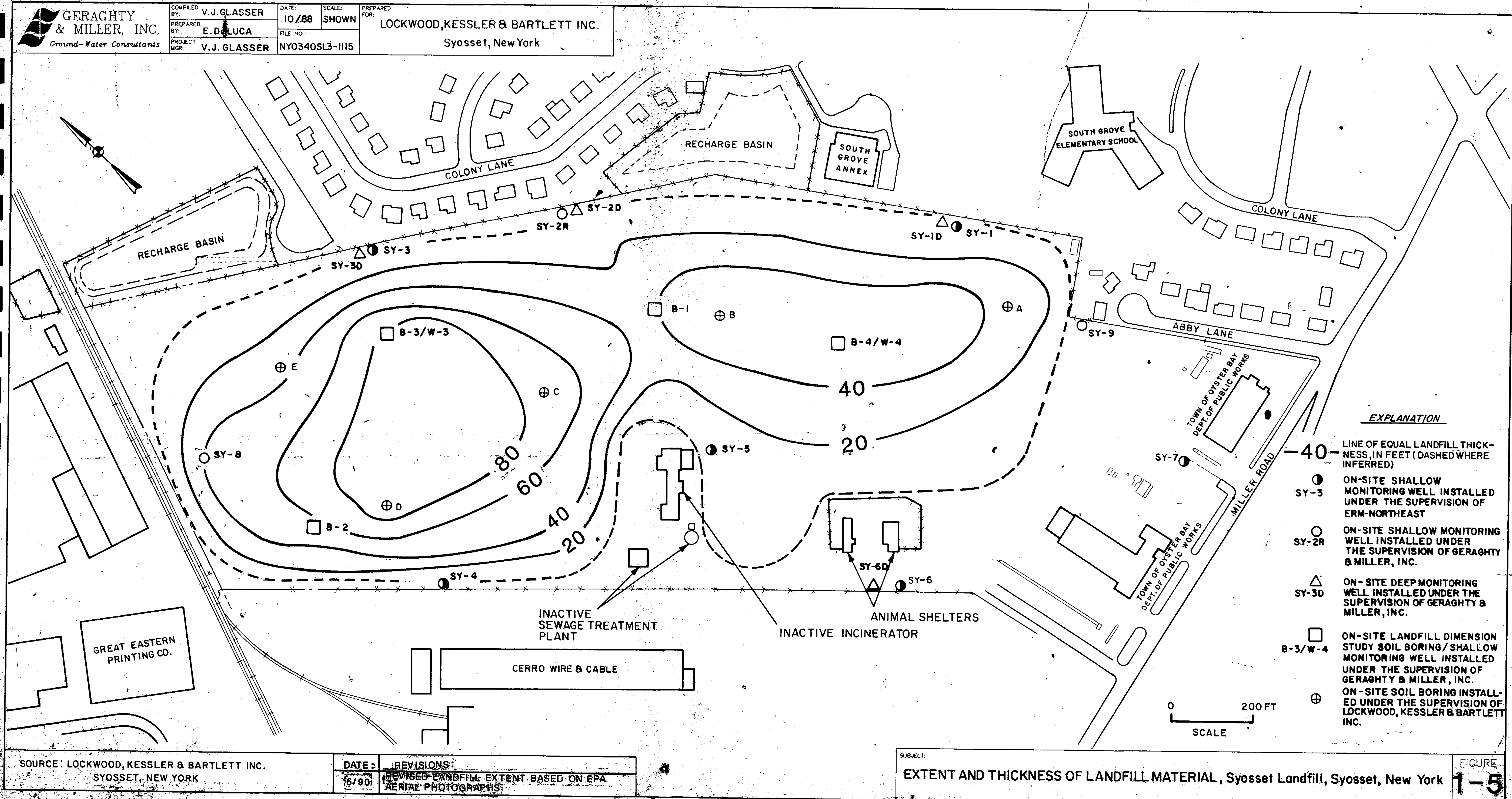
76 —— LINE OF EQUAL POTENTIOMETRIC SURFACE ELEVATION, IN FEET ABOVE MEAN SEA LEVEL (DASHED WHERE INFERRED)

— — APPROXIMATE LOCATION OF REGIONAL GROUND-WATER DIVIDE

▨ SYOSSET LANDFILL

REGIONAL POTENTIOMETRIC SURFACE OF THE SHALLOW ZONE OF THE MAGOTHY AQUIFER, IN THE VICINITY OF THE SYOSSET LANDFILL, ON NOVEMBER 18, 1988 SYOSSET, NEW YORK

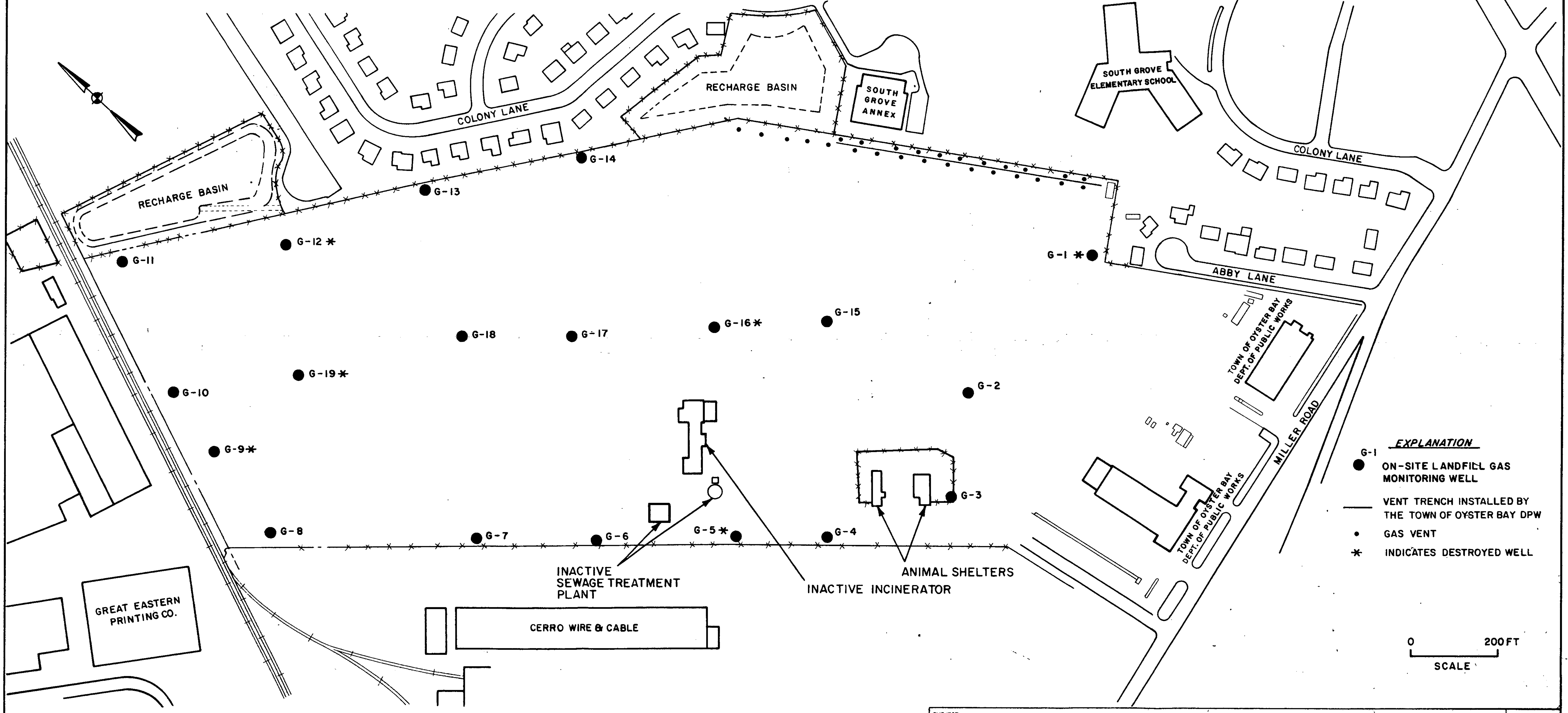
FIGURE 1-4



GERAGHTY & MILLER, INC.
Ground-Water Consultants
COMPILED BY: V.J.GLASSER
PREPARED BY: E.DeLUCA
PROJECT MGR.: V.J.GLASSER
DATE: 10/88
SCALE: SHOWN
FILE NO: NY0340SL3-1115
PREPARED FOR: LOCKWOOD, KESSLER & BARTLETT INC. Syosset, New York
RECHARGE BASIN
COLONY LANE
RECHARGE BASIN
SOUTH GROVE ANNEX
SOUTH GROVE ELEMENTARY SCHOOL
COLONY LANE
ABBY LANE
SY-2D
SY-2R
SY-3
SY-3D
SY-1D
SY-1
B-1
B
A
B-4/W-4
B-3/W-3
E
C
SY-9
SY-8
SY-5
SY-7
D
B-2
SY-4
SY-6D
SY-6
80
60
40
20
40
20
TOWN OF OYSTER BAY DEPT. OF PUBLIC WORKS
MILLER ROAD
TOWN OF OYSTER BAY DEPT. OF PUBLIC WORKS
INACTIVE SEWAGE TREATMENT PLANT
INACTIVE INCINERATOR
ANIMAL SHELTERS
GREAT EASTERN PRINTING CO.
CERRO WIRE & CABLE
EXPLANATION
—40— LINE OF EQUAL LANDFILL THICKNESS, IN FEET (DASHED WHERE INFERRED)
SY-3 ON-SITE SHALLOW MONITORING WELL INSTALLED UNDER THE SUPERVISION OF ERM-NORTHEAST
SY-2R ON-SITE SHALLOW MONITORING WELL INSTALLED UNDER THE SUPERVISION OF GERAGHTY & MILLER, INC.
SY-3D ON-SITE DEEP MONITORING WELL INSTALLED UNDER THE SUPERVISION OF GERAGHTY & MILLER, INC.
B-3/W-4 ON-SITE LANDFILL DIMENSION STUDY SOIL BORING/SHALLOW MONITORING WELL INSTALLED UNDER THE SUPERVISION OF GERAGHTY & MILLER, INC.
ON-SITE SOIL BORING INSTALLED UNDER THE SUPERVISION OF LOCKWOOD, KESSLER & BARTLETT INC.
0 200 FT
SCALE
SOURCE: LOCKWOOD, KESSLER & BARTLETT INC. SYOSSET, NEW YORK
DATE: 6/90
REVISIONS: REVISED LANDFILL EXTENT BASED ON EPA AERIAL PHOTOGRAPHS.
SUBJECT: EXTENT AND THICKNESS OF LANDFILL MATERIAL, Syosset Landfill, Syosset, New York
FIGURE 1-5

GERAGHTY & MILLER, INC.
Ground-Water Consultants

COMPILED BY: V.J.GLASSER	DATE: 10/88	SCALE: SHOWN	PREPARED FOR: LOCKWOOD, KESSLER & BARTLETT INC. Syosset, New York
PREPARED BY: E. DeLUCA	FILE NO: NY0340SL3-1115		
PROJECT MGR.: V.J. GLASSER			



SOURCE: LOCKWOOD, KESSLER & BARTLETT, INC.
SYOSSET, NEW YORK

SUBJECT: LOCATIONS OF LANDFILL GAS MONITORING WELLS, Syosset Landfill, Syosset, N.Y.

FIGURE 1-6

There are two recharge basins owned by Nassau County which border the site to the northeast and north. Nassau County recharge basin RB-284 (0.63 acres) borders the site to the northeast and Nassau County storm-water basin (SWB-571) (0.23 acres) borders the site to the north. Both basins collect storm water runoff from the neighboring residential area where the water either evaporates or recharges to the underlying Magothy aquifer.

1.2.1 Site Geology

The Syosset Landfill is located on Long Island, New York within the glaciated part of the Atlantic Coastal Plain physiographic province. Hydrogeologic investigations on Long Island and within the vicinity of the Town of Oyster Bay have been conducted by the United States Geological Survey (USGS) (Isbister 1966; Franke and Cohen 1972). These studies generally agree on the geologic description of the deposits underlying the site. The Syosset Landfill is underlain by more than 1,000 ft of unconsolidated deposits of sand, silt, gravel, and clay which rest unconformably on the bedrock surface. The bedrock is Precambrian in age and consists of crystalline metamorphic and igneous rock (schist, gneiss, and granite). The bedrock surface has a fairly constant slope of approximately 80 ft per mile (1.5 percent) and dips in a southeasterly direction (Isbister 1966). The unconsolidated deposits overlying the bedrock surface have an even gentler slope of 60 ft per mile (Isbister 1966).

The bedrock surface is directly overlain by Late Cretaceous deposits known as the Raritan Formation, which consists of two units or members: the Lloyd Sand Member (Lloyd aquifer) and the clay member (Raritan Clay). Beneath the site, the Lloyd Sand is approximately 240 ft thick and rests unconformably on the bedrock surface; the Raritan Clay is a major regional confining unit which is approximately 160 ft thick and overlies the Lloyd Sand (Isbister 1966).

The Magothy Formation, which is also a late Cretaceous deposit, lies unconformably on the Raritan Formation (i.e., Raritan Clay) and is approximately 540 ft thick beneath the site (McClymonds & Franke, 1972). The Magothy is a regional formation occurring throughout most of Long Island, except locally near the North Shore where erosion has removed parts or all traces of the Magothy and/or Raritan.

The deposits of the Magothy Formation, which are characterized by their light color and fine-grained texture, consist chiefly of interbedded lenses of sand, sandy clay, with varying amounts of silt. The primary mineral of the sandy beds is quartz (angular to subangular) with varying amounts of clay minerals, chert, muscovite, and a small percentage of dark, heavy minerals such as lignite and pyrite. Iron oxide is also found locally abundant.

Although a general value of porosity is frequently assumed to be 30 percent by investigators, Isbister (1966) reports laboratory results ranging from 32 to 41 percent.

Directly above the Magothy Formation lies the Pleistocene outwash deposits known as the Upper Glacial Formation (Upper Glacial aquifer); these deposits are characterized chiefly by stratified coarse sand and gravel. The surface of the Upper Clacial Formation on which the site is situated is known as outwash plain.

During the field investigation, the Geraghty & Miller hydrogeologists observed an apparently distinct separation (contact) between the Upper Glacial Formation and the underlying Magothy Formation. During drilling through the Magothy Formation, finer-grained sediments predominated and consisted of deposits of medium to fine-grained sand with clay stringers with or without silt, fine-grained sand with silt, and clay with sand and/or silt. Although less prevalent, some medium- to fine-grained sand with gravel was also encountered. Sediments of the Magothy Formation exhibited a broader range in color than the Upper Glacial Formation with colors ranging from white and black clay to white, gray, yellow, and tan sands. Cross sections A-A', B-B', and C-C' (Figure 1-3) illustrate this heterogenous composition of the Magothy Formation and illustrate the apparent contact between the finer grained Magothy deposits and the coarser grained Upper Glacial deposits.

1.2.2 Hydrogeology

Of the three unconsolidated geologic formations underlying the site (Upper Glacial, Magothy, and Raritan), only two are saturated: the Magothy Formation and the Raritan Formation. The Upper Glacial Formation is unsaturated in the vicinity of the site. The saturated portion of the Magothy Formation (Magothy aquifer) is the principal source of water for public and industrial use, therefore, most of the hydrogeological discussion will focus on this aquifer. The Lloyd Sand Member of the Raritan Formation is saturated (Lloyd aquifer) and is separated (confined) from the Magothy by the Raritan Clay (also saturated), which is a regional aquitard that is approximately 160 ft thick. Thus, although the Lloyd aquifer is used for water supply, this aquifer was not investigated because of its depth (approximately 760 ft beneath the site) and the presence of the Raritan Clay (160 ft thick).

1.2.2.1 Upper Glacial Formation

The Upper Glacial Formation is composed primarily of coarse sand and gravel deposited during the Pleistocene age, which ended approximately 15,000 years ago. These deposits were largely removed from the site due to the excavation (sand and gravel mining) of this material and subsequent filling during its use s a municipal landfill (1933 to 1975).

Prior to the mining of the sand and gravel deposits, the Upper Glacial Formation was approximately 60 to 100 ft in depth beneath the site. Unexcavated portions of this formation are found toward the boundaries of the site and beneath the landfill. Based on observations of geologic samples collected during the RI, the permeability of this formation is apparently greater than the Magothy, and it serves as the principal source of precipitation recharge to the Magothy. In areas located in the vicinity of (but beyond) the limits of the site where the Upper Glacial Formation is partially saturated, it is known as the Upper Glacial aquifer. The Upper Glacial aquifer and the underlying Magothy aquifer, are generally considered to be a single hydrogeologic unit as they are directly connected hydraulically (i.e., there is no continuous confining unit [aquitard] between the two aquifers).

1.2.2.2 Magothy Aquifer

The saturated portion of the Magothy Formation (Magothy aquifer) extends from the water-table surface (which occurs at approximately 100 to 115 ft below land surface) to the Raritan Clay. As stated previously, the Magothy aquifer is composed of fine-grained sediments: Intebedded sequences of sand with sandy clay, silt, and clay are prevalent through the unit. In the study area, the Magothy is directly (hydraulically) connected to the overlying Upper Glacial Formation area as no continuous confining beds (aquitards) are present. The Magothy aquifer is separated from the Lloyd aquifer by the Raritan Clay, a regional, continuous aquitard, which limits the groundwater flow between the groundwater systems.

As a result of the hetrogeneous nature of the Magothy aquifer, the water-transmitting properties can vary widely. Although the horizontal hydraulic conductivity in the Magothy aquifer in the vicinity of the site is reported to be approximately 400 gallons per day square foot (gpd/ft^2) (McClymonds and Franke, 1972), considerable variation is known to occur throughout this formation.

The groundwater flow direction in the shallow zone of the Magothy aquifer at the site and in the region (Figure 1-4) was observed to be consistently northeasterly. The groundwater flow direction in the deeper zone of the Magothy aquifer was observed to be consistently northerly. As Figure 1-4 indicates, the site is situated north of the regional groundwater divide. The vertical direction of groundwater flow was observed to be consistently downward across the site and appears to be more pronounced than the horizontal groundwater flow component.

1.2.3 Soils and Vadose Zone

The native soils at the site were removed during its use as a sand and gravel mining pit. After its use as a landfill, the site was reportedly covered with approximately 6 inches to 4 feet of a nearly flat layer of clean, sandy fill which forms the surface soil. This layer is recognized by the soil survey of Nassau County as being an Udorthent soil which consists of deep, excessively drained acid soils typcially used at sanitary landfills (U.S. Department of Agriculture, 1987). Usually, the surface is capped with a loamy veneer to encourage plant growth for stabilization. Udorthent soils are generally loose to firm, yellowish brown or pale brown loamy sand or sand.

1.2.4 Ecology

The site is located in a highly developed residential and industrial area which is not known to contain ecologically significant habitat. Surrounding land uses include industrial and commercial facilities to the south and west, Town of Oyster Bay Highway Yard to the east, and single-family homes to the north.

Most of the site is completely barren and with the remaining area consisting of sparse to moderately dense groupings of various hardwood trees, shrubs, and ground cover. Dominating tree species appear to be Black Locusts (4- to 8-inch diameter), Common Elder (2- to 6-inch diameter), and Chokecherry (2- to 6-inch diameter). Several varieties of broadleaf weeds, ivy, hawthorns, sumac, and various grasses make up the sparse understory along the perimeter of the property There was no evidence of significant or protected plant species on or adjacent to the property.

Wetlands are not present on or adjacent to the site. However, a low area that is on the northerly side of the site supports the growth of Giant Reed, a common freshwater wetland species. The occurrence of this species is most likely due to the infrequent ponding caused by storms.

The site offers minimal wildlife habitat and does not represent a significant environment. Since residential communities and industrial businesses surround the site, species that are sensitive to human activities, such as the red fox, are not common to this location. A variety of small mammals, such as the cotton-tail rabbit, gray squirrel, rats and mice, field birds and song birds are common inhabitants. Endangered or threatened wildlife species are not known to inhabit the subject site. The site does not contain habitat such as streams, ponds, or wetlands that might attract migratory bird species.

1.3 SITE HISTORY

The Syosset Landfill reportedly began operation as a municipal landfill in about 1936, and operated for approximately 40 years. During all of that time, the site was used to a substantial extent by local refuse transporters for disposal of general household and community waste and rubbish. The site was also used for disposal of wastes by nearby industrial entities. Some of the waste disposed of by these entities contained hazardous substances including heavy metals, volatile and semi volatile organic compounds, waste water treatment sludges, and solid wastes. From 1967 until its close in 1975, the site accepted only scavenger cesspool waste, which was processed at the treatment facility located near the defunct incinerator building, and industrial waste.

The site was excavated into two cells to depths of approximately 60 to 90 ft below land surface. In general, there was no segregation of wastes deposited at the site, with the exception of scavenger cesspool waste and tires. Scavenger cesspool wastes were treated at a facility located near the defunct incinerator building and tires were buried along the fence line in the vicinity of Well SY-4, as indicated by aerial photographs. Buried combustible fill materials were reportedly ignited and allowed to burn in portions of the landfill.

In or about 1974, the Nassau County Department of Health ("NCDOH") undertook an investigation with respect to suspected groundwater problems emanating from the landfill site. The Town of Oyster Bay closed the landfill completely in 1975 and since that time there has been no unauthorized dumping at the landfill. Soil borings taken subsequent to landfill closure confirmed that the cover material placed over the solid waste deposited at the site consisted of clean sand and silt ranging in depths from six inches to four feet. Currently, portions of the landfill are utilized for leaf composting, materials storage and vehicle/equipment storage and parking. In 1983, the EPA placed the site on the National Priorities List, which is set forth at CFR Part 300, Appendix B. In 1986, the EPA and the Town of Oyster Bay entered into an administrative consent order, pursuant to which the Town agreed, among other things, to undertake a remedial investigation and to prepare this feasibility study with respect to the site.

1.4 NATURE AND EXTENT OF CONTAMINATION

The nature and extent of contamination at the site were determined during the three phases of the Interim (on-site) RI (First Operable Unit RI): the On-Site Groundwater Study; the Landfill Dimension Study; and the Subsurface Gas Study. The results of these studies are summarized below.

1.4.1 Groundwater Quality

Groundwater quality underneath and downgradient of the landfill has apparently been impacted by leachate as evidenced by leachate indicator parameters (chloride, ammonia, alkalinity, hardness, total dissolved solids, specific conductance, and iron) detected in on-site monitoring wells. The extent of the leachate plume will be the subject of the Second Operable Unit (off-site) RI/FS.

Individual volatile organic compounds (VOCs) were detected in some on-site groundwater monitoring wells, but the distribution and concentrations were not consistent with a contiguous body (plume) of groundwater contamination with the landfill as the source. PCBs were not detected in on-site groundwater monitoring wells; other classes of organic compounds (base/neutral and acid extractable compounds) were either not detected or were found in unquantifiable concentrations and/or in the method blanks.

1.4.2 Extent and Thickness of the Landfill

The Syosset Landfill is approximately 35 acres in size, extending from the LIRR in the northwest to the vicinity of Well SY-9 toward the southeast. This is consistent with a previous investigation which arrived at similar conclusions. The landfill occupies most of the area between the northern and southern boundaries of the site, except for the areas surrounding the animal shelter and the defunct incinerator which appear to be situated atop native soils.

The areal extent and thickness of the landfill is depicted on Figure 1-5. As illustrated on this figure, the landfill appears to be divided into two lobes with an existing road coinciding with the ridge separating the two lobes. The deepest lobe of the landfill is found in the central part of the western half of the site where a depth of approximately 91 ft was encountered in Soil Boring D. The other lobe appears to reach a maximum thickness of approximately 58 ft in Soil Boring B-4 which is in the central part of the eastern half of the site, northeast of the defunct incinerator building.

1.4.3 Soil Quality of the Fill Material

VOCs, base/neutral extractables, leachable metals, and PCBs were detected in some samples of landfill material. As detectable concentrations of these compounds varied appreciably, both laterally and vertically, a contaminant distribution pattern was not evident either within each class of compounds or among the four classes of compounds.

A distribution or pattern of the same compound(s) would be expected if a large quantity of a particular waste were deposited at a particular depth or in a particular area of the landfill. However, the sampling results obtained during the Remedial Investigation are more consistent with the random deposition of industrial, commercial, and residential wastes.

1.4.4 Extent and Quality of Landfill Gases

Landfill gas was measured on a monthly basis by monitoring 19 shallow gas monitoring wells installed throughout the site (Figure 1-6). High concentrations of landfill gases (mostly methane) were detected in the central part of the landfill and in the southwestern corner of the landfill. Relatively lower concentrations of landfill gases were detected along the northern, eastern, and southern boundaries. Frequently, concentrations of landfill gases were not detected, or nearly so at these boundary areas.

A passive gas ventilation system consisting of a trench (which parallels the fence separating the site from the South Grove Elementary School), and a series of vertical venting pipes within the trench, have been monitored for the presence of methane gas by the TOB-DPW since 1981.

Since that time, whenever methane has occasionally been detected in the vent pipes, the TOB-DPW has routinely rehabilitated the system to maintain its effectiveness. However, methane has reportedly never been detected in two permanent gas monitoring points on the school property.

Individual VOCs were detected in some landfill gas samples, but not in consistent concentrations or distributions. Landfill gases do not appear to be migrating vertically upwards under significant pressure.

1.5 BASELINE RISK ASSESSMENT

The Remedial Investigation Report for the Syosset Landfill (G&M, 1989) indicated that a Baseline Risk Assessment for the on-site FS may not be necessary. The RI Report determined what remedial actions to be described in the On site Feasibility Study to mitigate certain potential exposure pathways.

In the absence of any on-site remedial action, the RI Report identified the following potential exposure pathways which may exist.

- Direct contact and/or ingestion with fill materials if existing cover and site security is compromised.

- Inhalation of landfill gases if existing cover and site security are compromised and/or landfill gases migrate uncontrolled.

Since the Remedial Investigation Report was able to identify potential exposure pathways to be mitigated by on-site remedial actions, a Baseline Risk Assessment is not required to identify those pathways. Therefore, the Feasibility Study will address remedial actions necessary to mitigate the above-listed exposure pathways.

SECTION 2

IDENTIFICATION AND SCREENING OF TECHNOLOGIES

2.1 INTRODUCTION

This section provides the criteria necessary to develop and screen potential remedial technologies. Remedial action objectives are established for each of the environmental media of interest (groundwater, soil and air) in relation to the contaminants of concern, potential transport mechanisms and allowable exposure limits. Remediation goals are set and general response actions are developed to accomplish these goals. Remedial technologies are then identified and screened to select those technologies which will meet all the established remedial action objectives and goals.

An Endangerment Assessment (EA) was prepared for the Syosset Landfill by Versar, Inc. in April 1990 under contract to the U.S. Environmental Protection Agency (USEPA). The EA Report utilized sampling data generated during the on-site Remedial Investigation to identify the potential risks to human health and the environment posed by the site in its current condition.

2.2 REMEDIAL ACTION OBJECTIVES

Remedial action objectives have been developed for the site to identify media-specific (groundwater, soil and air) goals for protecting human health and the environment. These objectives are established based on contaminant levels found at the site and potential exposure routes as reported in the site's Remedial Investigation Report. Since this First Operable Unit Feasibility Study (FS) addresses on-site remediation measures, the remedial action objectives addressed herein will only relate to on-site remediation. Off-site remediation measures, if any, will be identified during the Second Operable Unit Remedial Investigation/ Feasibility Study (RI/FS) process, which will be initiated upon the completion of this First Operable Unit Feasibility Study.

2.2.1 Contaminant Transport Media

The two predominant contaminant transport media to be addressed in this First Operable Unit FS Report are on-site soil and air. The corresponding on-site transport mechanisms identified in the site's Remedial Investigation Report include the degradation of on-site cover materials and subsurface gas migration. Discussions of contaminant transport through groundwater will be limited in this Draft First Operable Unit FS Report to addressing potential future levels of on-site leachate generation.

In order to quantify the risks associated with each transport media, twelve indicator chemicals have been chosen to develop risk assessment values in this Feasibility Study. These chemicals include: arsenic, barium, zinc, benzene, chlorobenzene, chloroform, methylene chloride, vinyl chloride, tetrachloroethene, toluene, trichloroethene and bis (2-ethylhexyl) phthalate.

It is anticipated that the contaminant transport media to be investigated and addressed during the Second Operable Unit RI/FS process will be groundwater. The associated transport mechanism will therefore be potential off-site migration of leachate impacted groundwater.

2.2.2 Applicable or Relevant and Appropriate Requirements (ARAR's)

Under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), the selection of remedial actions at National Priorities List (NPL) sites must comply with all Applicable or Relevant and

Appropriate Requirements (ARAR's) of all Federal and State environmental laws (USEPA, 1988b).

The following definitions of ARAR's are proposed in the National Contingency Plan (NCP):

> Applicable requirements mean those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.
>
> "Applicability" implies that the remedial action or the circumstances at the site satisfy all of the jurisdictional prerequisites of a requirement. If a requirement is not applicable, one must consider whether it is both relevant and appropriate.
>
> Relevant and appropriate requirements mean those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or State law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. However, in some circumstances, a requirement may be relevant but not appropriate for the site-specific situation.

The ARAR's are separated into three categories: chemical-specific, location-specific and action-specific. Chemical-specific ARAR's are usually health- or risk-based values which are acceptable concentrations of chemicals in the ambient environment. If a chemical has more than one

ARAR, the more stringent requirement is generally complied with. Location-specific ARAR's restrict the concentrations of hazardous substances or the type of activities conducted at a site based solely on the site's location. Examples of these types of locations include floodplains, wetlands, historic places and sensitive ecosystems or habitats. Action-specific ARAR's are usually technology- or activity-based requirements or limitations imposed on remedial actions (i.e. RCRA requirements).

Both Federal and State ARAR's have been evaluated with respect to their applicability to on-site remediaton activities at the Syosset Landfill, and are listed in Tables 2-1 and 2-2, respectively. The following paragraphs discuss the reasoning behind the determination of applicability for both Federal and State ARAR's. The ARAR's are presented in groups based on whether they are chemical-specific, location-specific, or action-specific for comparison purposes.

The sources for the chemical-specific ARAR's which are applicable to on-site remediation include the Clean Air Act (CAA), National Air Quality Standards and the New York State Guidelines of Toxic Ambient Air Contaminants. These are applicable due to their restrictions or levels of air contaminants which may be released from on-site surface soils. All groundwater quality ARAR's (i.e., RCRA MCL's; SWDA MCL's, MCLG's and SMCL's; NIPDWR; 6 NYCRR Part 703 and N.Y.S. Sanitary Code) are considered potentially applicable to this site due to their possible applicability to public water supply sources. However, the groundwater quality ARAR's will be addressed during the off-site (Second Operable Unit) remediation effort and therefore are not considered applicable for this FS.

TABLE 2-1 Table 12

POTENTIAL FEDERAL ARAR's
AND THEIR APPLICABILITY TO THE SYOSSET LANDFILL

Chemical-Specific ARAR's	Applicability
Resource Conservation and Recovery Act (RCRA)	
Maximum Contaminant Levels (MCL's)	Potentially Applicable
Safe Drinking Water Act (SDWA)	
MCL's	Potentially Applicable
MCL Goals (MCLG's)	Potentially Applicable
Secondary MCL's (SMCL's)	Potentially Applicable
National Interim Primary Drinking Water Regulation (NIPDWR)	Potentially Applicable
Clean Water Act (CWA)	
Ambient Water Quality Criteria (WQC)	Not Applicable
Effluent Discharge Limitations	Not Applicable
Pretreatment Standards for Publicly Owned Treatment Works (POTW's)	Not Applicable
Ocean Discharge Regulations	Not Applicable
Dredge and Fill Standards	Not Applicable
Clean Air Act (CAA)	
National Ambient Air Quality Standards (NAAQS)	Applicable
Location-Specific ARAR's	
RCRA Location Requirements	Not Applicable
National Historic Preservation Act	Not Applicable
Endangered Species Act	Not Applicable
Wilderness Act	Not Applicable
Fish and Wildlife Coordination Act	Not Applicable
Wild and Scenic Rivers Act	Not Applicable
Coastal Zone Management Act	Not Applicable
Clean Water Act	Not Applicable
Action-Specific ARAR's	
RCRA Waste Management Requirements	Potentially Applicable
Subtitle C - Hazardous Waste Management Requirements	
Subtitle D - Solid Waste Management Requirements	Potentially Applicable
Subtitle I - Underground Storage Tank Regulations	Not Applicable
Clean Air Act (CAA)	
National Ambient Air Quality Standards	Applicable

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Table 13

TABLE 2-2

POTENTIAL NEW YORK STATE ARAR's
AND THEIR APPLICABILITY TO THE SYOSSET LANDFILL

Chemical-Specific ARAR's	Applicability
New York State Department of Environmental Conservation (NYSDEC) Water Quality Regulations, Groundwater Classifications and Standards (6NYCRR Part 703)	Potentially Applicable
New York State Department of Health Drinking Water Standards (N.Y.S. Sanitary Code)	Potentially Applicable
New York State Ambient Air Quality Standards for Criteria Air Pollutants	Not Applicable
New York State Guidelines for the Control of Toxic Ambient Air Contaminants	Applicable
Location-Specific ARAR's	
All N.Y.S. Location-Specific ARAR's (Similar to Federal Listing)	Not Applicable
Action-Specific ARAR's	
NYSDEC, Division of Solid Waste Solid Waste Management Facilities Requirements (6 NYCRR Part 360)	Applicable

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There are currently no Federal or State chemical-specific ARAR's for soil. However, the USEPA has developed potential soil guidelines to be considered (TBC's) for the Syosset Landfill site. These TBC's are summarized in Table 2-3.

The chemical-specific ARAR's which are not applicable for this site are the Federal Clean Water Act (CWA) and the N.Y.S. Ambient Air Quality Standards for Criteria Air Pollutants (NYSAAQS). The CWA is not applicable since there are no proposed surface water discharges, POTW discharges or dredge and fill operations associated with this site. The NYSAAQS is not applicable since criteria air pollutants were not detected at the site furing the Remedial Investigation.

All of the Federal and State location-specific ARAR's are not applicable to this site since the site is not located in a historic, coastal or flood plain area and does not impact any endangered species, wild or scenic rivers or historic landmarks. In addition, RCRA location-specific requirements are not applicable since site operations did not involve underground mines, caves, salt domes or salt bed formations, and the site is not within a flood plain or an area which has unacceptable siesmic conditions.

Action-specific ARAR's which apply to on-site landfill closure operations include the requirements for N.Y.S. Solid Waste Management Facilities (6NYCRR Part 360), and potentially either RCRA Subtitle C-Hazardous Waste Management Requirements or RCRA Subtitle D - Solid Waste Management Requirements. In addition, the Clean Air Act will be applicable to any on-site gas collection systems, if required. Action-specific ARAR's which are not applicable to this site include the RCRA Subtitle I - Underground Storage Tank Regulations since there are no underground storage tanks at the property which was once operated as the Syosset Landfill.

TABLE 2-3

POTENTIAL SOIL TBCs FOR SYOSSET LANDFILL

	HEALTH BASED CRITERIA		
	CARCINOGENS (A) (mg/kg)	SYSTEMATIC TOXICANTS (B) (mg/kg)	AVERAGE CONCENTRATIONS (C) (mg/kg)
Volatile organic compounds			
Acetone	NA	8,000	NA
Carbon disulfide	NA	8,000	NA
MethylENE Chloride	93	70	NA
Chloroform	110	800	NA
Tetrachloroethene	140	800	NA
Chlorobenzene	NA	2,000	NA
2-Butanone	NA	NA	NA
Ethylbenzene	NA	8,000	NA
Total Xylenes	NA	200,000	NA
Semivolatile organic compounds			
Naphthalene	NA	NA	NA
Diethylphthalate	NA	60,000	NA
Flourene	NA	NA	NA
Phenanthrene	NA	NA	NA
Anthracene	NA	NA	NA
Di-n-butylphthalate	NA	8,000	NA
Fluoranthene	NA	NA	NA
Pyrene	NA	NA	NA
Benzo(a)anthracene	0.224	NA	NA
bis(2-Ethylhexyl)phthalate	NA	2,000	NA
Chrysene	NA	NA	NA
Di-n-octylphthalate	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA
Benzo(a)pyrene	0.0609	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA
Target analyte list			
Aluminum	NA	NA	71000
Arsenic	NA	NA	5
Calcium	NA	NA	NA
Chromium (III)	NA	8,000	100
Chromium (VI)	NA	400	NA
Copper	NA	NA	30
Magnesium	NA	NA	5000
Manganese	NA	NA	600
Zinc	NA	NA	50
Potassium	NA	NA	NA
Barium	NA	4,000	430
Iron	NA	NA	NA
PCBs			
Aroclor-1016	0.091	NA	NA
Aroclor-1254	0.091	NA	NA

(A) - Health-Based Criteria for Carcinogens, Oral Exposure Route Table 8-6 of Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations. EPA 530/SW-89-031, May 1989.
(B) - Health-Based Criteria for Systemic Toxicants Table 8-7 of Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations. EPA 530/SW-89-031, May 1989.
(C) - SW 874 Hazardous Waste Land Treatment (Lindsay, 1979).

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2.2.3 Allowable Exposure Based on Endangerment Assessment

This section summarizes the findings of the site's Endangerment Assessment which were reviewed prior to incorporation into this FS. The Endangerment Assessment performed for the Syosset Landfill evaluated the potential risks to human health and the environment associated with the site in its current state. Impacts to human health were investigated for noncarcinogenic and carcinogenic indicator chemicals. Environmental effects from the site were determined based on potential impacts, sensitive environments or wildlife habitats in the vicinity of the site.

Although the risk estimates presented in the Endangerment Assessment fall within the USEPA acceptable range, these risk estimates would be substantially less if more realistic assumptions were made, as discussed in the Town of Oyster Bay's June 11, 1990 letter to the USEPA (Appendix A). The following paragraphs discuss the Endangerment Assessment procedures and the risk estimates for the site. Although the risks associated with the site are within the USEPA acceptable range, the Town of Oyster Bay anticipates remediating the site in a manner which will protect the public health, welfare and the environment from potential future releases of contaminants from the site.

Noncarcinogens

The noncarcinogenic effects from potential exposure to the indicator chemicals found at the site were evaluated for both oral and inhalation routes. Anticipated health impacts were identified by computing hazard indices derived from subchronic and chronic daily intake levels. The hazard index is used to compare daily intake levels to acceptable daily intake levels. The assumption made in the site's Endangerment Assessment for calculating hazard indices is that the combined effects of chemicals is additive. In general, EPA policy states that if the hazard index is less than one, deleterious health effects are unlikely. If the hazard index is greater than one, then the individual effects of each chemical should be considered to determine the likelihood of ill effects.

The computed noncarinogenic hazard indices for adults and children are based on models which estimate risks associated with the ingestion of contaminated groundwater. Since the estimates of groundwater concentrations are based on assumptions which are not appropriate (ie., distance to the closest supply well, filtered versus unfiltered samples, etc.), it would be more accurate to compute the hazard indices based on actual off-site groundwater concentrations which will be determined during the Second Operable Unit Remedial Investigation. Therefore, the reported hazard indices will not be addressed in this First Operable Unit Feasibility Study.

Carcinogens

Risks were estimated for potential carcinogens based on the probability of increased cancer incidence. The anticipated carcinogenic risk for each indicator chemical was calculated for each exposure pathway by multiplying the lifetime average daily exposure level with the respective chemical-specific carcinogenic potency factor. The carcinogenic potency factor represents the upper 95-percent confidence limit of the probability of response per unit intake of a particular contaminant over a lifetime. The estimated intakes are then converted into incremental risk.

However, since all inputs into the exposure assessments are conservatively based, the Endangerment Assessment reported that the resulting calculated risks identified for the Syosset Landfill site represent upper-bound risk estimates, and may overestimate the actual risk from exposure to the indicator chemical.

The cumulative upper bound carcinogenic risk for adults and children for both oral and inhalation exposures as reported in the Endangerment Assessment are listed in Table 2-4. The estimated total upper bound risk for adults and children are 3.65×10^{-5} and 2.53×10^{-5}, respectively, which are within the EPA acceptable range of 1×10^{-4} to 1×10^{-7}.

The Endangerment Assessment reported that there are a number of uncertainties associated with calculating the carcinogenic risk estimate which include: (1) the need to extrapolate below the dose range of experimental tests using animals, (2) the variability of the receptor population, (3) assumed equivalency of dose-response relationship between animals and humans, and (4) differences in exposure routes in test animals versus routes expected on site. In addition to contaminant concentration, route, and duration of exposure, there are also many other factors that may influence the likelihood of developing cancer. These include differences between individual nutritional and health status, age and sex, and inherited characteristics that may affect susceptibility. Risk calculations also assume that intake levels will be small, without synergistic or antagonistic chemical effects, and that individuals will be exposed to each of the indicator chemicals and elicit a carcinogenic response (Versar, 1990).

TABLE 2-4

CARCINOGEN RISK ESTIMATES

	ADULT	CHILDREN
TOTAL UPPER BOUND RISK		
Oral & Inhalation	3.65×10^{-5}	2.53×10^{-5}

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Environment

Anticipated environmental effects due to releases from the Syosset Landfill are expected to be negligible. The site's Endangerment Assessment determined that the site offers minimal wildlife benefits since it contains no streams, ponds or established wetlands. In addition, off-site environmental risks are not likely since there are no endangered, threatened or rare plant or animal species located within a one mile radius of the site, and there were no rare breeding bird species identified in the immediate vicinity of the site.

Summary

Although the associated on-site risks to human health and the environment are within the USEPA acceptable range, remedial measures are required to comply with certain ARAR's as applicable to the site. The off-site exposure pathways, if any, will be evaluated during the Second Operable Unit RI/FS process.

2.2.4 On-Site Remedial Action Objectives

The remedial action objectives to be met by this FS consist of on-site mitigation measures to minimize or eliminate the potential impacts caused by the inhalation of VOC's from on-site soils, direct dermal contact with on-site surface soils, and on-site measures to reduce future leachate generation. In addition, the effects of on-site remediation on potential off-site pathways (ie, groundwater) is addressed. Table 2-5 lists the remedial action objectives for each of the transport media.

TABLE 2-5

ON-SITE REMEDIAL ACTION OBJECTIVES

Transport Media	Remedial Action Objective
Soil	- Prevent the ingestion or dermal contact with soil containing noncarcinogens in excess of reference doses. - Prevent ingestion or dermal contact with soils containing levels of carcinogens which exceed the EPA acceptable risk limit. - Prevent the inhalation of soil particles with carcinogens in concentrations which exceed the EPA acceptable risk limit during construction.
Air	- Prevent the inhalation of carcinogens in concentrations which exceed the EPA acceptable risk limit.
Groundwater	- Minimize the potential for future leachate generation.

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2.3 GENERAL RESPONSE ACTIONS

General response actions are defined as those types of actions which will satisfy the remedial action objectives. The general response actions are media-specific and include the no action, source control, subsurface gas control and groundwater control actions. A list of general response actions for each transport media at the site is shown in Table 2-6. The general response actions are further discussed in the following sections.

2.3.1 Previously Implemented Response Actions

Previously implemented response actions at the site include an existing 500 foot long passive gas venting trench and a series of vertical venting pipes which parallel the Landfill property line in the vicinity of the South Grove School property. The system has been monitored by the Town of Oyster Bay Department of Public Works (TOB DPW) since 1981. Since that time, methane has occasionally been detected in the vent pipes, most notably in the fall of 1988, which prompted the TOB DPW to rehabilitate the system. To date, methane has never been detected at the two permanent gas monitoring meters on the school property.

2.3.2 No Action Response

The no action response would retain the landfill in its current condition. No site remediation would be performed and continued monitoring of groundwater and subsurface gas would be required. Although the no action response would not eliminate any existing contaminant transport mechanisms, it will be retained for comparison to other response actions in accordance with CERCLA requirements.

TABLE 2-6

ON-SITE GENERAL RESPONSE ACTIONS

Transport Media	General Response Actions

Soil	- No Action
	- Source Control
	  - Containment (Capping)
	  - Removal/Disposal
	  - Removal/Treatment

Air	- No Action
	- Gas Control
	  - Passive Gas Venting
	  - Active Gas Venting
	  - Gas Collection/Treatment
	  - Gas Collection/Utilization

Groundwater	- No Action - Groundwater Control - Containment (Capping)

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2.3.3 Source Control

The source control response consists of actions which would reduce or eliminate the contaminant source. These actions would include containment, removal/disposal and removal/treatment. The containment action involves capping the 35 acre site, thereby eliminating contact with potentially contaminated surface soils and minimizing landfill leachate production which could lead to groundwater contamination. The removal/disposal option would require the removal of the estimated three million cubic yards of waste deposited at the site, the transportation and disposal of the waste to an approved RCRA facility with subsequent filling operations to return the site to its former state prior to mining operations. The removal/treatment response action would consist of removing the three million cubic yards of fill, treating the material to remove the contaminants and utilizing the material as fill to restore the site to its original grade. Both removal actions remove the source of contamination which eliminates the potential for contact with contaminated surface soils, the production of landfill gases, and leachate production which could contaminate the groundwater in the vicinity of the site.

2.3.4 Subsurface Gas Control

Subsurface gas control actions would reduce or eliminate the potential for gas migration at the site. In addition to the previously discussed no action and source control effects on subsurface gas control, specific actions could be taken to minimize gas migration. These actions include the use of passive or active gas venting systems. Passive venting systems commonly consist of perforated pipe vents and permeable soil material which is placed in layers or trenches to enhance gas migration to points where the gas can be vented and treated, if necessary. Active systems utilize a series of pipe vents placed into the fill material which are connected via a header system to a blower facility which produce a line of negative pressure inducing gas migration toward the vent pipes where the gas is vented or possibly converted to energy.

2.3.5 Groundwater Control

Groundwater control actions would be introduced to minimize the potential for groundwater contamination in the vicinity of the site. Response actions which may be implemented in addition to the no action or source control responses include the containment of contaminated groundwater through the use of vertical or horizontal barriers and the collection and treatment of contaminated groundwater. However, since the extent of off-site groundwater contamination will be identified and addressed in the Second Operable Unit RI/FS process, the only groundwater control response actions which will be discussed in this report will be the no action and source control (ie, capping) responses previously discussed.

2.4 IDENTIFICATION AND SCREENING OF TECHNOLOGIES

This section of the Feasibility Study identifies and screens potentially applicable technology types and process options by evaluating their effectiveness, implementability and cost considerations. The effectiveness of each technology is evaluated based on its potential effectiveness in handling the estimated volumes of media, its ability to meet the remedial action objectives, the potential impact to human health and the environment during construction and implementation and whether the process is a proven and reliable option with respect to the contaminants involved. Implementability encompasses both the technical and administrative feasibility of implementing a technology process, eliminating those technology types and process options which are clearly ineffective or unworkable at a site. Cost considerations play a limited role at this level of the screening process. Cost analysis is made on the basis of engineering judgment and each process is evaluated as to whether costs are high, low or moderate relative to other process options in the same technology type. At this point in the screening of technologies, effectiveness factors are focused on, with less importance given to implementability and costs. Those technologies which do not satisfactorily meet these criteria are eliminated from further consideration. Table 2-7 summarizes the effectiveness, implementability and cost considerations for each of the remedial technologies.

2.4.1 Source Control Technologies

Source control technologies have been developed to minimize or eliminate the potential for contaminant migration from the source. This is accomplished by either restricting contact with the source material or removing the source material entirely. The following paragraphs discuss the current source control technologies which include containment, removal/disposal and removal/treatment.

Containment

Containment of potentially contaminated soils at the site involves the placement of an impermeable cover over the existing fill material. Containment technologies are advantageous since they allow the waste materials to remain in place while the cover system minimizes future exposure pathways. Capping systems have been used for years during landfill closure operations and have proven to be an effective and reliable means of protecting human health and the environment. Several types of

TABLE 2-7

Identification and Screening of On-site Remedial Technologies

General Response Action	Remedial Technology	Process Option	Screening Comments	Effectiveness	Implementability	Cost	Retain
1. No Action	None	Not Applicable	o Required by NCP o Requires continued monitoring o Potential exposure pathways will remain o Leachate production will continue	Does not meet remedial action objectives	Not acceptable to local/public government agencies	Low cost incurred for continued monitoring	Yes
2. Source Control A. Containment	Capping	A-1. Clay A-2. Synthetic A-3. Asphalt A-4. Multimedia	All Process Options: o Eliminate surface soil exposure o Minimize future leachate production o Require gas venting	All process options meet remedial action objectives A-1. Effective, susceptible to cracking but has self-sealing properties A-2. Effective, susceptible to punctures A-3. Effective, but susceptible to weathering & cracking A-4. Effective, least susceptible to cracking	All process options are easily implemented & have restrictions for future land use	A-1. High capital, low maintenance A-2. High capital, low maintenance A-3. High capital, moderate maintenance A-4. High capital, moderate maintenance	Yes
B. Removal/Disposal	Excavation	Disposal	o Large volume for excavation & disposal (3 million CY) o Eliminates source and future exposure pathways	Meets remedial action objectives	Feasible but impractical due to large volume of soil to be excavated, staged & disposed of at a RCRA facility	High	No
C. Removal/Treatment	Excavation	Treatment C-1. Incineration C-2. Chemical, biological in-situ treatment	C-1. On-site or off-site incineration C-2. Not effective for low levels of contaminants	C-1. Meets remedial action objectives C-2. Not effective for low levels of contaminats found at the site Does not meet remedial action objectives	C-1. On-site inciner-ation requires permitting & has potential for air emissions C-1. Impractical due to the large volume of soil to be excavated. C-2. Not an effective method of treatment.	C-1. High C-2. N/A	No
3. Subsurface Gas Control A. Passive Gas Venting	Gas Venting	Passive Vents and Trenches	o May eliminate potential for off-site subsurface gas migration o Minimum requirement for use in conjunction with containment action under source control	o Meets remedial action objectives o Effectiveness decreases with depth	Easily implemented	Low to high (dependent on depth)	Yes

TABLE 2-7 (Cont'd.)

Identification and Screening of On-site Remedial Technologies

General Response Action	Remedial Technology	Process Option	Screening Comments	Effectiveness	Implementability	Cost	Retain
3. Subsurface Gas Control (cont'd.) B. Active Gas Venting	Gas Venting	Active vents connected to a blower system	o Eliminates potential for off-site subsurface gas migration o Will satisfy requirement for gas control in conjunction with containment action under source control	o Meets remedial action objectives o More effective than passive system for reducing subsurface gas migration, but would only be implemented if passive system was ineffective	o Easily implemented o Would be implemented if passive system proved to be not effective at reducing gas migration	High	No
C. Active Gas Collection/ Treatment	Gas Collection/Treatment	Active vents connected to a blower/treatment system.	o Eliminates potential for off-site gas migration o Eliminates potential for air emissions	o Meets remedial action objectives o Effective if potential exists for air emissions from subsurface gases	o Treatment technologies are extremely costly	High	No
D. Active Gas Collection/ Utilization	Gas Collection and Utilization	Active gas collection system connected to gas to energy facility	o Eliminates potential for off-site subsurface gas migration o Potential energy source	o Meets remedial action objectives o Not effective due to low levels of gas at the site	Not practical due to low levels of gas at the site	High	No
4. Groundwater Control Containment	Low Permeability Barrier	Clay, Synthetic Caps	Capping technology & process options are discussed under Source Control	Effective at reducing future leachate production & subsequent groundwater contamination	Easily implemented	High	Yes

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capping materials are available for containment purposes including clay, geosynthetic membranes, asphalt or combinations of these materials to provide a multi-media cover system.

All of the capping options achieve several of the remedial action objectives for this site. The landfill cap provides a barrier layer over the potentially contaminated site surface soils eliminating any possible future exposure to on-site workers and residents within the vicinity of the site. The impermeable capping material will minimize future precipitation infiltration and subsequent leachate production. In addition, gas ventilation systems installed in conjunction with capping materials restrict subsurface gas migration.

Current pertinent containment ARAR's include the New York State 6 NYCRR Part 360 regulations and potentially the Resource Conservation and Recovery Act (RCRA) Subtitle C regulations. These ARAR's stipulate requirements for landfill closure and post-closure activities. In general, the final landfill capped section consists of a multi-layered system comprised of a bottom layer of permeable material for gas venting, overlain by an impermeable barrier layer which is covered by a barrier protection layer. The surface of the capped section must be properly maintained and graded to induce adequate stormwater drainage which is discharged beyond the capped area. The permeable gas venting layer must have provisions for a gas collection and venting system to release any landfill gases trapped under the cap to prevent off-site gas migration and cap degradation.

While capping technologies are easily implemented and are cost effective, actual cap efficiency and cost effectiveness are dependent upon the individual materials used. All capping technologies will have restrictions on future land use at the site. Table 2-7 provides a comparison of the effectiveness, implementability and cost considerations for capping sections which use clay, geosynthetic membranes, asphalt and multi-media materials for low permeability barriers. Although clay caps are susceptible to cracking, they have self-sealing properties and have relatively high capital and low maintenance costs. Synthetic membranes are susceptible to punctures and have high capital and low maintenance costs. Asphalt cover materials are susceptible to weathering and cracking and have high capital costs and moderate maintenance costs. Multimedia caps are the least susceptible to failure by cracking or punctures but have high capital and moderate maintenance costs.

Removal/Disposal

Removal and disposal technologies require the removal of potentially contaminated soils at the site for subsequent disposal at a licensed facility. Although this procedure meets the remedial action objectives, it is not practical or cost effective due to the quantity of solid wastes deposited at the landfill. A total of three million cubic yards of waste were landfilled at the 35 acre site over the years, placed at depths up to 90 feet below ground surface. Once this waste is excavated it would have to be carted off Long Island to a licensed RCRA facility. After the waste is removed, clean fill material would have to be brought in to fill the site to existing ground surface elevations.

Partial removal of contaminated soils located in "hot spots" throughout the landfill would be a more feasible option. However, this is not appropriate at the Syosset Landfill, since the results of the on-site Remedial Investigation observed contaminants dispersed throughout the site.

Costs for removing and disposing of on-site waste material would be prohibitive. Current rates for the shipping and disposal of hazardous waste to a licensed facility are approximately $230/cubic yard. The approximate cost for removal, disposal and filling operations would be approximately 775 million dollars.

Removal and disposal technologies will be eliminated from further consideration due to their impracticability and prohibitive costs.

Removal/Treatment

The removal and treatment option consists of excavating the existing solid waste materials, treating them to remove contaminants and depositing them on-site. While this procedure meets the remedial action objectives, it would still require the removal of three million cubic yards of fill material for treatment. Partial removal of material would once again not be practical since contaminants appear to be dispersed throughout the site.

Several methods are available for both on-site and off-site treatment including incineration and in-situ chemical or biological treatment. On-site incineration would require the construction of an incinerator since the existing facility is not in an operable condition. This option would have high capital costs, could lead to air emissions in excess of New York State Air Quality Guidelines, would require permitting, and would likely be opposed by the local residents. Therefore, this would not be a viable technology. Off-site incineration would have to be performed in a licensed RCRA facility. In general the total cost for removal, transportation, treatment and filling operations would be on the order of 1 billion dollars. In-situ chemical or biological treatment would not be an appropriate option since this type of treatment is not effective for the low concentrations of contaminants found at the site.

Removal and treatment technologies will be eliminated from further consideration since they either do not provide an implementable or cost effective means of meeting the remedial action objectives.

2.4.2 Subsurface Gas Control Technologies

Subsurface gas control technologies are generally implemented to prevent potential off-site landfill gas migration. Landfill gas is the collective term used for gases produced during the decay of organic matter contained in solid waste. The major components of landfill gas are carbon dioxide and methane, with lesser amounts of oxygen, nitgrogen and hyrdrogen sulfide and trace amounts of volatile organic compounds. The major transport process for subsurface gas is convection. Convection properties involve gas migration from regions of high pressure to low pressure. Lateral methane migration away from landfills is common since landfills tend to be at higher pressures than the surrounding ground due to the production of many cubic feet of gases in one cubic foot of refuse. Migration is also enhanced through the installation of impermeable capping materials during landfill closure which trap the landfill gas and increase the pressure buildup and therefore the lateral migration.

Process options available to prevent gas migration include both passive and active gas venting systems, and may involve the treatment or utilization of gas for energy depending on site characteristics. Although gas venting and collection systems may be implemented on their own at landfill sites, they are most effective when installed in conjunction with a low permeability capping system which increase lateral gas migration and directs the gas migration to particular venting points. Since capping is the source control technology retained for further consideration, the gas control technologies will be discussed assuming the site will be capped.

Current technologies available for gas control at landfills are categorized as either passive or active systems. Passive systems are used to intercept methane as it migrates under natural convective processes. These types of systems consist of one or more of the following: a permeable material such as gravel to provide a pathway for gas migration; impermeable barriers such as PVC liners or clay caps to restrict or confine gas migration; and perforated piping gas vents at various depths below ground surface.

Active gas control systems are similar to passive systems with the addition of equipment to create an area of low pressure which induces gas migration toward it. The gas is then collected and either vented, treated or utilized for energy.

All of these gas control technologies effectively meet the remedial action objective of preventing subsurface gas migration and are easily implemented. Current New York State landfill closure ARAR's require the installation of a passive gas venting system comprised of at least one gas vent riser per acre, to prevent off-site gas migration. If levels of VOC's or methane in landfill gas are expected to be high, then an active gas collection system is appropriate. At sites where VOC's in gas exceed air emission standards, once collected, gas treatment is required. If methane levels are high, then an active gas collection system can burn methane and convert it to energy.

The particular system to use is dependent on site characteristics. As part of the on-site Remedial Investigation, measurements for methane and individual volatile organic compounds were taken at 13 on-site landfill gas vents. Methane levels throughout the site were generally low with the exception of one area in the southwestern portion of the site. This is consistent with the age of the wastes which were deposited at the site between 1933 and 1967. Since this waste was deposited between 23 and 57 years ago, methane production is on the decline. In general, levels of volatile organic compounds (VOC's) measured in the landfill gas at the site during the Remedial Investigation were lower than the ARAR's, with the exception of one VOC which was measured slightly above the ARAR's during one of the sampling rounds. Considering that the levels of that VOC measured in the on-site soil and groundwater samples were also low (equal to or below the ARAR's), it is likely that the higher readings measured during that one sampling round are not representative of site conditions.

Therefore, based on the site characteristics, it is anticipated that a passive gas venting system will be the appropriate method for gas control since projected levels of VOC's and methane are considered too low for treatment or energy utilization. However, the passive system will be monitored and should levels of VOC's be detected in excess of ARAR emission standards, the passive system will be designed with interconnecting piping between vent risers so that a treatment system can be easily connected to the passive gas system.

2.4.3 Groundwater Control Technologies

Several groundwater control technologies are available including capping, low permeability barriers, hydraulic barriers, and groundwater treatment systems. Of these technologies, only the capping option will be addressed in this First Operable Unit FS. The remaining technologies will be considered when further data is gathered during the Second Operable Unit remedial investigation.

As discussed previously, capping is a source control technology which places an impermeable barrier over the existing fill material. The capping medium minimizes the amount of rainwater infiltration into the fill material, thereby reducing leachate production. In addition, leachate production caused by fluctuations in the groundwater table is unlikely, since the water table elevation is approximately 20 feet below the deepest part of the landfill.

SECTION 3

DEVELOPMENT AND SCREENING OF ALTERNATIVES

3.1 DEVELOPMENT OF ALTERNATIVES

This section of the Feasibility Study groups the selected remedial technologies into proposed alternatives which meet the remedial action objectives. While the technologies have been previously formulated in Section 2 for each transport media, they are now combined into alternatives which treat the site as a whole.

3.1.1 Summary of Selected Remedial Technologies

The three remedial technologies which have been retained thus far include the no action, capping and gas venting technologies. Although the no action option does not contain any remedial technologies, it has been retained for comparison purposes during the alternative screening process in accordance with CERCLA requirements. Capping technologies have been retained due to their effectiveness in eliminating contact with potentially contaminated surface soils and reducing leachate formation and subsurface gas migration. Of the gas control options discussed, it is anticipated that a passive gas venting system with the capabilities of conversion to an active gas venting system will be the appropriate process option for eliminating potential off-site gas migration.

3.1.2 Grouping of Selected Remedial Technologies into Alternatives

The selected remedial technologies are grouped into two categories of alternatives; the no action and closure alternatives. The no action alternative category consists of a single no action alternative, while the site closure category consists of four landfill closure alternatives. The no action alternative involves retaining the site in its current condition, and requires continued groundwater and subsurface gas monitoring. The closure alternative category consists of capping the site, installing a passive gas venting system, grading the site and providing a surface treatment which enhances proper stormwater runoff.

The four closure alternatives propose the use of standard cap sections which meet either State or Federal ARAR's for landfill closure. The appropriate cap sections to be retained for detailed analysis in subsequent sections of this report will be determined during the initial alternative screening process.

New York State regulations for landfill closure are stipulated in 6 NYCRR Part 360 - Solid Waste Management Facilities. These regulations call for the construction of a final cover and gas control system. The final cover system consists of a bottom layer of permeable gas venting material, overlain by a low permeability barrier layer covered by a barrier protection layer. The gas control system must be designed to prevent off-site gas migration; prevent the accumulation of gas in concentrations greater than 25 percent of the lower explosive limit in on-site and off-site structures; prevent damage to final cover vegetation and off-site vegetation; and control objectionable odors from gas emissions. A perimeter gas control system is also required if landfill gases are found to pose a hazard to health, safety or property, or if concentrations of gas at the site boundaries exceed the lower explosive limit.

New York State landfill closure regulations stipulate that the required low permeability barrier may consist either of a layer of low permeability soil or a geosynthetic membrane. Three of the four final cover system alternatives provide low permeability barriers consistent with current New York State Landfill closure regulations. They are: low permeability soil (clay), geosynthetic membrane; and low permeability asphalt.

Federal regulations for landfill closure are contained under the Resource Conservation and Recovery Act (RCRA) Subtitle C for Hazardous Waste Management and Subtitle D for Solid Waste Management. It is likely that Subtitle C requirements are more appropriate due to the types of wastes which were reportedly disposed of at this site over the years. The fourth alternative to be screened consists of a multi-media cap which is consistent with the RCRA-Subtitle C regulations.

3.1.3 Future Site Use

Current landfill closure ARAR's limit future site uses to ensure that the integrity of the final cover system is not jeopardized. Since the existing landfill ground surface elevations are comparable to the surrounding areas and proposed closure slopes will be approximately four percent, potential future uses for the landfill include utilizing the site, or portions thereof, for highway yard operations, materials storage, composting, vehicle parking or a materials recycling facility. All future site uses, including those proposed herein, will be restricted to ensure the integrity of the cap and the protection of public health. A final cover surface treatment which would accommodate these uses and improve the cap efficiency is a bituminous asphalt concrete layer. An asphalt pavement course will provide a surface which will minimize stormwater infiltration and promote stormwater runoff. Asphalt maintains a runoff factor of 0.9 to 1.0 while a vegetative cover surface treatment has a runoff factor of 0.3 to 0.5. This indicates that approximately 90 to 100 percent of precipitation which falls on the asphalt surface becomes stormwater runoff. In comparison, a vegetative cover surface will result in runoff quantities of 30 to 50 percent. In terms of infiltration, asphalt allows 0 to 10 percent infiltration, while a grass surface and growing medium layer allows 50 to 70 percent infiltration. These comparisons show that using a surface of asphalt pavement significantly reduces the amount of infiltration which will reach the low permeability capping material below. Consequently, the asphalt cover will substantially increase the efficiency of the cap section since potential infiltration will be reduced by as much as 70 percent compared to a growing medium cover.

Since an asphalt cover will provide a more efficient cap section and will accommodate all anticipated future site uses, it will be retained as the proposed surface treatment for all closure alternatives. Any areas on-site whose anticipated future use does not require an asphalt surface will utilize the standard vegetative cover material specified in the ARAR's. Figure 3-1 shows the vegetative cover cap section which will be used for each alternative. Should the use of these areas change in the future, an asphalt surface will be laid over the existing cap section.

3.1.4 Summary

The following alternatives have been formulated for screening purposes:

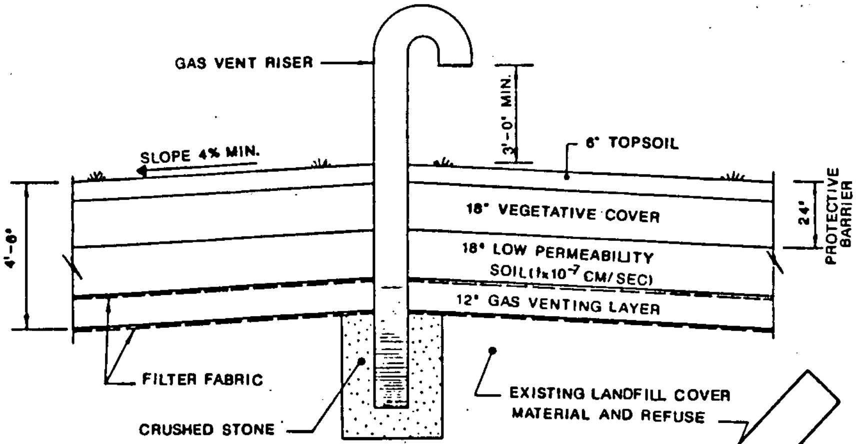
Alternative Group No. 1 - No Action

Alt. No. 1 - No Action

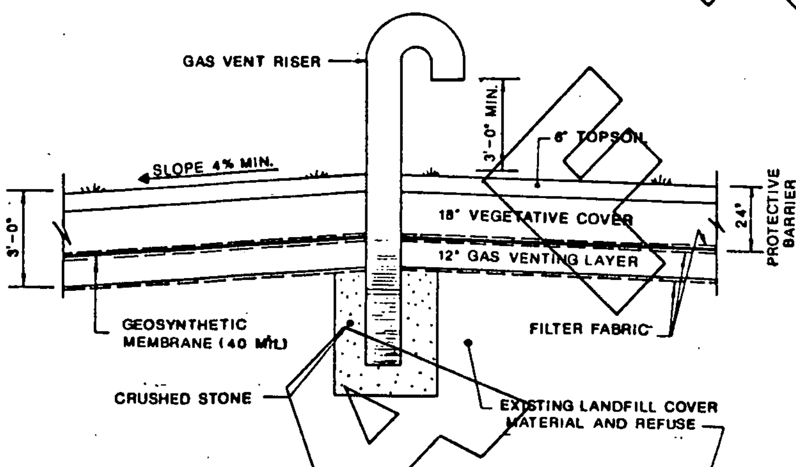
Alternative Group No. 2 - Closure with Asphalt Surface Treatment

Alt. No. 2A- 6 NYCRR Part 360 Regulations - Low Permeability Soil Cap

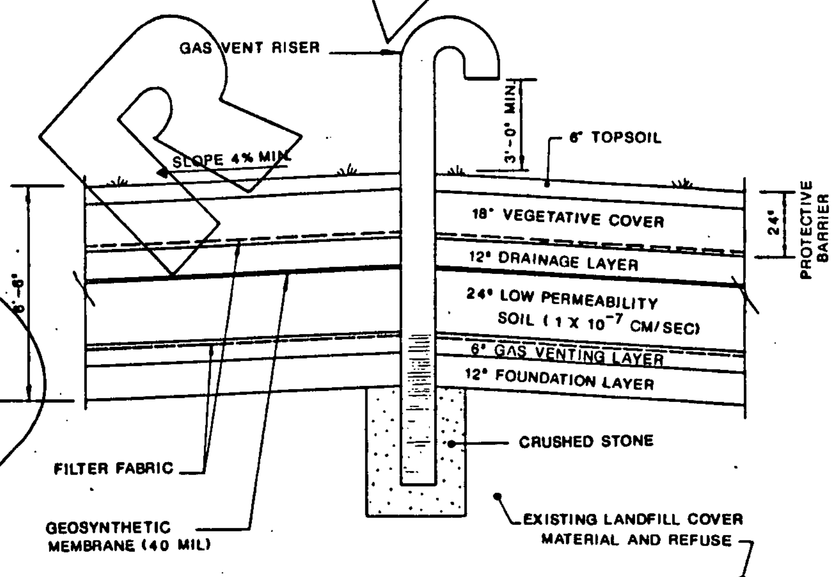
Alt. No. 2B- 6 NYCRR Part 360 Regulations - Geosynthetic Membrane Cap



ALTERNATIVE 2A



ALTERNATIVE 2B & 2C



ALTERNATIVE 2D

NOTE: THESE CAP SECTIONS WILL BE UTILIZED WHERE ASPHALT IS NOT REQUIRED.

FIGURE 3-1

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VEGETATIVE COVER - CAP SECTIONS

Alt. No. 2C- 6 NYCRR Part 360 Regulations - Low Permeability Asphalt Cap

Alt. No. 2D- RCRA Regulations - Subtitle C - Multi-media Cap

3.2 SCREENING OF ALTERNATIVES

3.2.1 Introduction

The alternatives which were defined in the previous section are now evaluated based on short-and long-term effectiveness, implementability and cost. The effectiveness of each alternative refers to the short-term (i.e., construction and implementation period) and long-term (i.e., period subsequent to implementation) effectiveness of each alternative to provide protection of human health and the environment, and the reductions in toxicity, mobility or volume that it will achieve. Implementability is evaluated by both the technical and administrative feasibility of constructing, operating and maintaining a remedial action alternative. Alternative costs are compared using a present worth analysis of capital and operation and maintenance costs assuming a discount rate of 10 percent over a common period of operation of 30 years as recommended in the USEPA Remedial Action Costing Procedures Manual (Burgher, et.al., 1987). At this state in the screening process, costs are compared on an order of magnitude basis. A more accurate analysis will be performed in Section 4.

During the closure alternative screening process, comparisons are based on the characteristics of each capping alternative. However, the cost comparison includes items which are common to all closure alternatives, such as site preparation, a site drainage system, a passive gas control system, a 25 foot wide landscape buffer zone along the site property line adjacent to residences, and the use of vegetative cover over each of the cap sections in areas where asphalt pavement is not required. Site preparation costs include the demolition of the inactive incinerator building and sewage treatment plant, and site clearing and grubbing costs. During the preparation of the site's closure plan, investigations will be made to determine the method of incorporating the on-site salt-spreader parking area and existing salt storage shed as part of the landfill cap. Contingencies have been provided in the site preparation cost to upgrade these facilities if necessary.

The purpose of this initial alternative screening process is to retain those alternatives with the most favorable composite evaluation of all factors and eliminate those alternatives which do not satisfactorily meet these criteria. In addition, Section 121 of CERCLA provides that an alternative which meets an ARAR may be eliminated if it qualifies with one of the following six CERCLA waiver criteria for ARAR's:

1. Interim Measures

   The remedial action selected is only part of a total remedial action that will attain such level or standard of control when completed. (CERCLA 121(d)(4)(A).)

2. Greater Risk to Health and the Environment

   Compliance with such requirement at the facility will result in greater risk to human health and the environment than alternative options. (CERCLA 121(d)(4)(B).

3. Technical Impractibility

Compliance with such requirement is technically impracticable from an engineering perspective. (CERCLA 121 (d)(4)(C).)

4. Equivalent Standard of Performance

The remedial action selected will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, criteria, or limitation, through use of another method or approach (CERCLA 121(d)(4)(D).)

5. Inconsistent Application of State Requirements

With respect to a State standard, requirement, criteria, or limitation, the State has not consistently applied (or demonstrated the intention to consistently apply) the standard, requirement, criteria, or limitation in similar circumstances at other remedial actions. (CERCLA 121(d)(4)(E).

6. Fund Balancing

In the case of a remedial action to be undertaken solely under Section 104 using the Fund, selection of a remedial action that attains such level or standard of control will not provide a balance between the need for protection of public health and welfare and the environment at the facility under consideration, and the availability of amounts from the Fund to respond to other sites which present or may present a threat to public health or welfare of the environment, taking into consideration the relative immediacy of such threats. (CERCLA 121(d)(4)(F).)

3.2.2 Alternative No. 1 - No Action

Description

The No Action alternative would retain the site in its existing condition. However, several institutional controls would have to be implemented at the site. These include leaving the vegetative cover on the Landfill as it currently exists and continued monitoring of the groundwater and air quality at the Landfill.

Effectiveness

The No Action alternative would not have any short-term effects on the surrounding community since no construction would be required.

The No Action alternative would be ineffective in the long-term since it does not meet the remedial action objectives of eliminating contact with site surface soils, and minimizing future leachate production and subsurface gas migration.

Implementability

This alternative would be easily implemented, requiring only the maintenance of the existing boundary fencing to discourage trespassers and the continued monitoring of groundwater and subsurface gas levels using the existing monitoring well system. The No Action alternative is not administratively feasible since it does not meet the requirements of current waste facility closure regulations.

Cost

Costs incurred for the No Action alternative would be limited to site maintenance and monitoring costs. No capital costs would be required to implement this alternative. The order of magnitude present worth value for estimated annual maintenance and monitoring costs of the No Action alternative is 1 million dollars. Monitoring costs may be increased over the years as the area of leachate-impacted groundwater moves further off-site, enlarging the monitoring area.

Evaluation Summary

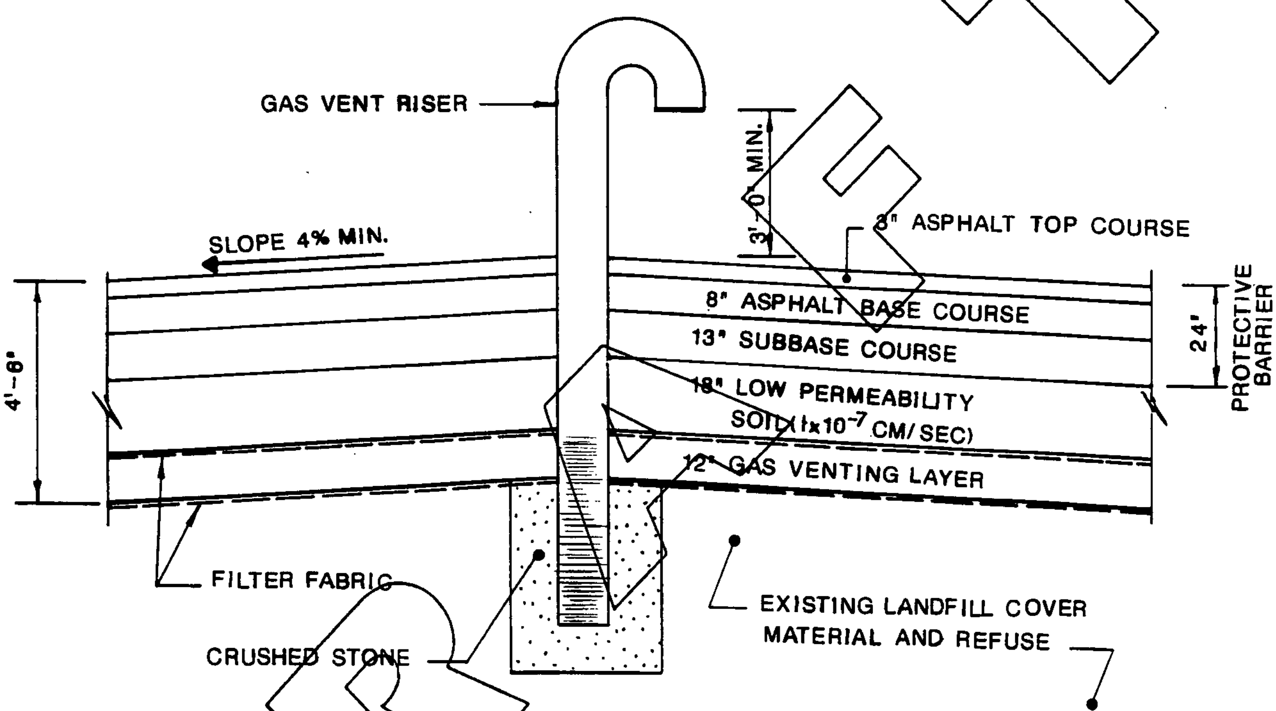
Although this alternative is not effective in protecting human health and the environment, it will be retained for the detailed analysis of alternatives for comparison purposes in accordance with CERCLA guidelines.

3.2.3 Alternative No. 2A - 6 NYCRR Part 360 Regulations - Low Permeability Soil Cap

Description

Alternative 2A consists of the 6 NYCRR Part 360 low permeability soil cap for landfill closure. The minimum cap section is shown in Figure 3-2 and consists of the following layers:

- 24" barrier protection layer consisting of:
  - 3" asphalt top course



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6 NYCRR PART 360
LOW PERMEABILITY SOIL CAP

FIGURE 3-2

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ALTERNATIVE 2A-CAP SECTION

- 8" asphalt base course
- 13" subbase course

- 18" low permeability soil layer ($1x10^{-7}$ cm/sec)
- two layers of geosynthetic filter fabric
- 12" gas venting layer
- clean fill placed over the existing landfill cover material to construct a minimum slope of 4 percent
- gas riser vents extending from within the refuse material to 3'-0" above the final ground surface elevation (minimum of one gas riser vent per acre)
- crushed stone backfill around gas venting risers

Effectiveness

The short-term effects that Alternative 2A will have on human health and the environment are all construction related. These effects include increased vehicular traffic from trucks delivering fill and capping materials, minor increases in noise levels due to construction equipment, fugitive dust emissions, and potential exposure to site surface soils and subsurface gases for construction workers. Although excavation is required during the installation of the 4'-6" cap in order to meet existing grades around the edge of the landfill, encounters with on-site waste material should be limited since there is approximately 6 inches to 4 feet of existing cover material over the refuse. All excavated materials will be left on-site and used as fill material. There will be no excess excavated material for this alternative.

Mitigation measures to minimize short-term impacts include restricting vehicular routes to non-residential areas, limiting construction operation periods to daytime hours when local residents are at work, spraying work areas with water to minimize dust generation and air monitoring in the work zone to prevent exposure to gases in concentrations greater than the Occupational Safety & Health Administration (OSHA) limits. The anticipated duration of construction activities for this alternative is expected to be 36 months.

Alternative 2A will have virtually no effect on the reduction of toxicity, mobility and volume of contaminants at the site since no treatment is proposed. However, the proposed capped section will reduce future rainwater infiltration and leachate production which will minimize the source of future groundwater contamination.

Cap efficiencies were calculated for each alternative using NYSDEC procedures. The initial cap efficiency of the low permeability soil layer of Alternative 2A is 90.4 percent, which is greater than 90 percent as stipulated in the ARAR's. The installation of the asphalt surface treatment will substantially increase this efficiency since the asphalt cover will limit the amount of infiltration that reaches the clay cap to less than 10 percent of the rainwater which falls on the site. This added protection will increase the total cap efficiency to 99.04 percent (i.e. 90.4 percent efficiency of the 10 percent of water which reaches the clay cap).

The Alternative 2A cap section is designed to provide long-term beneficial effects to human health and the environment, while also possessing properties to ensure its effectiveness and integrity. The 4'-6" cap section eliminates exposure to potentially contaminated surface soils, minimizes rainwater infiltration and controls subsurface gas migration. The cap maintains a minimum slope of four percent to promote surface stormwater runoff to reduce stormwater infiltration. The 24" barrier protection layer consists of a 3" bituminous asphalt concrete top course on an 8" asphalt base course and a 13" subbase course. Utilizing asphalt as a surface treatment over the cap section will significantly increase the efficiency of the cap section. The asphalt cover material, having a runoff coefficient of 0.9 to 1.0, will promote surface stormwater runoff while reducing infiltration to less than 10 percent of the precipitation that falls on the site.

The 18" low permeability soil layer, having a maximum permeability of 1×10^{-7} cm/sec, further minimizes rainwater percolation thereby reducing future leachate production and potential groundwater contamination. Subsurface gas migration is controlled through gas ventilation layers and gas vent risers. Landfill gases which rise through the fill material are prohibited from rising further by the clay cap. The permeable gas venting layer below the clay layer induces gas migration to the gas vent risers which vent the gas into the atmosphere. Gas concentrations at these locations will be monitored on a regular basis to ensure that levels of VOC's and methane are at acceptable limits.

The Alternative 2A cap section is also designed to insure its integrity and maintain its effectiveness over its useful life. The surface layer consists of 24" of cover material to create a protective barrier over the clay cap. Since asphalt will be used in lieu of a vegetative cover, there will be no potential for roots penetrating the clay cap or for animals burrowing through the cap, reducing the risk of cap failure. In addition, the 18" clay cap itself provides a minimum opportunity of failure. While clay is susceptible to cracking due to freezing and landfill settlement, it has self sealing properties which enable it to adjust to these dynamic elements. Annual inspections of the protective barrier layer of the cover system will be required to identify potential areas in need of repair.

Implementability

Clay cap sections similar to Alternative 2A have been frequently used over the years for landfill closure operation. Clay caps have been proven as an acceptable, effective and reliable means of eliminating various human health and environmental exposure pathways. They are easily implemented with services and materials which are readily available. Although 1×10^{-7} cm/sec clay is available, it is no longer available locally. Clay caps require moderate levels of maintenance in comparison to other closure technologies. The use of 6 NYCRR Part 360 clay caps also require minimal requirements for NYSDEC approval, thereby leading to timely implementation of this remedial action alternative.

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Cost

The order of magnitude present worth value for capital, operation, maintenance and monitoring costs for Alternative 2A is 33 million dollars. This cost is sensitive to the current availability and pricing of clay and clean fill. Current costs for obtaining clay have been quite high, ranging around $90/cubic yard.

3.2.4 Alternative No. 2B - 6 NYCRR Part 360 Regulations - Geosynthetic Membrane Cap

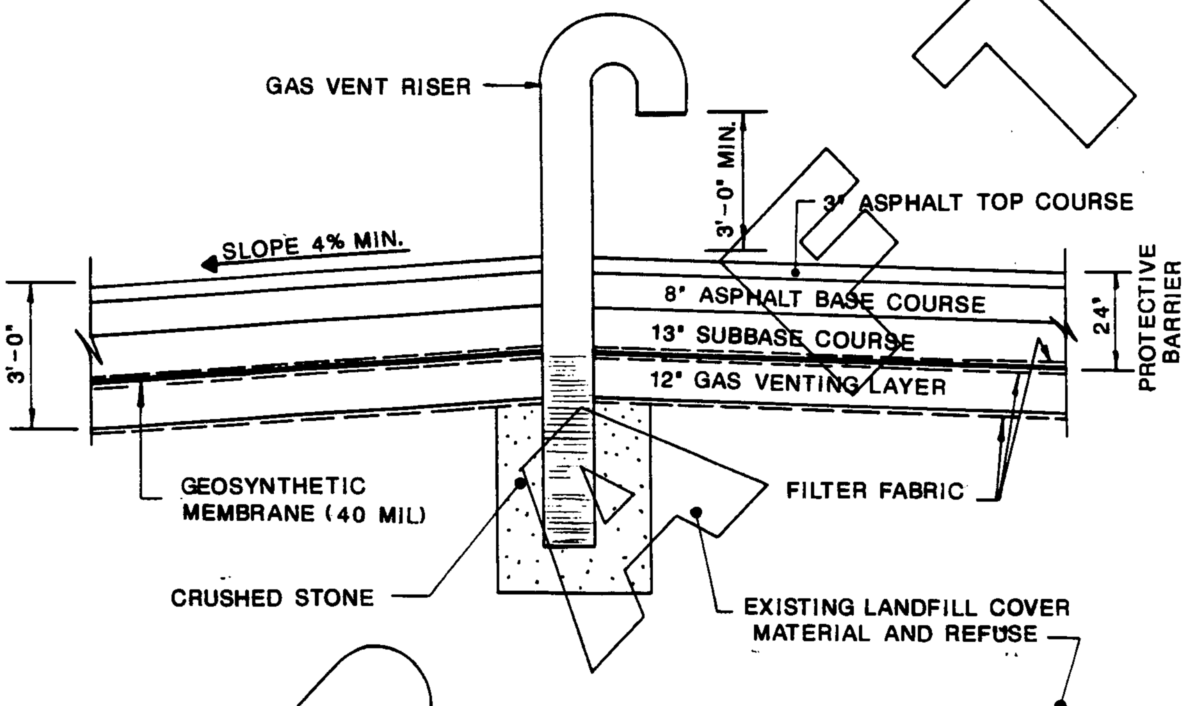
Description

Alternative 2B consists of the 6 NYCRR Part 360 geosynthetic membrane cap for landfill closure. The minimum cap section is shown in Figure 3-3 and consists of the following layers:

- 24" barrier protection layer consisting of:
  - 3" asphalt top course
  - 8" asphalt base course
  - 13" subbase course
- geosynthetic membrane (40 mil @ 1×10^{-12} cm/sec)
- 12" gas venting layer
- three layers of filter fabric
- clean fill placed over the existing landfill cover material to construct a minimum slope of four percent
- gas riser vents extending from within the refuse material to 3'-0" above the final ground surface elevation (minimum of one gas riser vent per acre)
- crushed stone backfill around gas venting risers

Effectiveness

The short-term effects that Alternative 2B will have on human health and the environment are all construction related and are similar to Alternative 2A. These effects include minor increases in noise levels due to construction equipment, fugitive dust emissions, and potential exposure to site surface soils and subsurface gases for construction workers. The



6 NYCRR PART 360 GEOSYNTHETIC CAP

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FIGURE 3-3

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ALTERNATIVE 2B-CAP SECTION

anticipated duration of construction activities for this alternative is expected to be 30 months. Although Alternative 2B does not require the delivery of clay material to the site, vehicular traffic will be slightly increased (in comparison to Alternative 2A) since this alternative requires the placement of more fill material to meet the proposed site grades. Encounters with on-site waste material will be less than Alternative 2A since less excavation is required to install the 3'-0" cap in order to meet existing grades around the edge of the landfill. No excess excavated material will be generated by this alternative.

Mitigation measures to minimize short-term impacts are similar to Alternative 2A and include restricting vehicular routes to non-residential areas, limiting construction operation periods to daytime hours when local residents are at work, spraying construction work areas with water to minimize dust generation and air monitoring in the work zone to prevent exposure to gases in concentrations greater than the Occupational Safety & Health Administration (OSHA) limits.

Alternative 2B will have virtually no effect on the reduction of toxicity, mobility and volume of contaminants at the site since no treatment is proposed. However, the proposed capped section will reduce future rainwater infiltration and leachate production which will minimize future levels of groundwater contamination.

Cap efficiencies were calculated for each alternative using NYSDEC procedures. The initial cap efficiency of the geosynthetic membrane layer of Alternative 2B is 94.3 percent, which is greater than 90 percent as stipulated in the ARAR's. The installation of the asphalt surface treatment will substantially increase this efficiency since the asphalt cover will limit the amount of infiltration that reaches the geosynthetic membrane layer to less than 10 percent of the rainwater which falls on the site. This added protection will increase the total cap efficiency to 99.43 percent (i.e. 94.3 percent efficiency of the 10 percent of water which reaches the geosynthetic membrane cap).

The Alternative 2B section is designed to provide long-term beneficial effects to human health and the environment, while also possessing properties to ensure its effectiveness and integrity. The 3'-0" cap section eliminates exposure to potentially contaminated surface soils, minimizes rainwater infiltration and controls subsurface gas migration. The cap maintains a minimum slope of four percent to promote surface stormwater runoff to reduce stormwater infiltration. The 24" barrier protection layer consists of a 3" bituminous asphalt concrete top course on an 8" asphalt base course and a 13" subbase course. Utilizing asphalt as a surface treatment over the cap section will significantly increase the efficiency of the cap section. The asphalt cover material, having a runoff coefficient of 0.9 to 1.0, will promote surface stormwater runoff while reducing infiltration to less than 10 percent of the precipitation that falls on the site.

The geosynthetic membrane, having a maximum permeability of 1×10^{-12} cm/sec, further minimizes rainwater percolation thereby reducing future leachate production and potential groundwater contamination. Subsurface gas migration is controlled through gas ventilation layers and gas vent risers. Landfill gases which rise through the fill material are prohibited from rising further by the geosynthetic membrane. The permeable gas venting layer below the membrane induces gas migration to the gas vent risers which vent the gas into the atmosphere. Gas concentrations at these locations will be monitored on a regular basis to ensure that levels of VOC's and methane are at acceptable limits.

The Alternative 2B cap section is also designed to insure its integrity and maintain its effectiveness over its useful life. The surface layer consists of 24" of cover material to create a protective barrier over the geosynthetic membrane. Since asphalt will be used in lieu of a vegetative cover, there will be no potential for roots penetrating the membrane or for animals burrowing through the membrane. The use of the asphalt cover will therefore completely eliminate these two means of cap failure. Although the geosynthetic membrane is not susceptible to cracking due to freezing, it is susceptible to punctures and tears both during installation and following installation due to differential landfill settlement. Unlike a clay cap, the geosnythetic membrane does not possess self sealing properties. Once the membrane is punctured a hole or tear will remain, enabling water to seep into the landfill reducing the cap efficiency. Annual inspections of the protective barrier layer of the cover system will be required to identify potential areas in need of repair.

Although geosynthetic membranes have been used as both caps and liners at landfills, they are a relatively recent technology that have generally not been in place for more than 30 years. The membrane may therefore need to be replaced at some point in the future.

<u>Implementability</u>

Geosynthetic membranes have been used over the years for both landfill closure caps and landfill liner systems. Geosynthetic caps have been proven as an acceptable, effective and reliable means of eliminating various human health and environmental exposure pathways. They are easily implemented with services and materials which are readily available. The use of 6 NYCRR part 360 geosynthetic membrane caps also require minimal requirements for NYSDEC approval, thereby leading to timely implementation of this remedial action alternative.

Cost

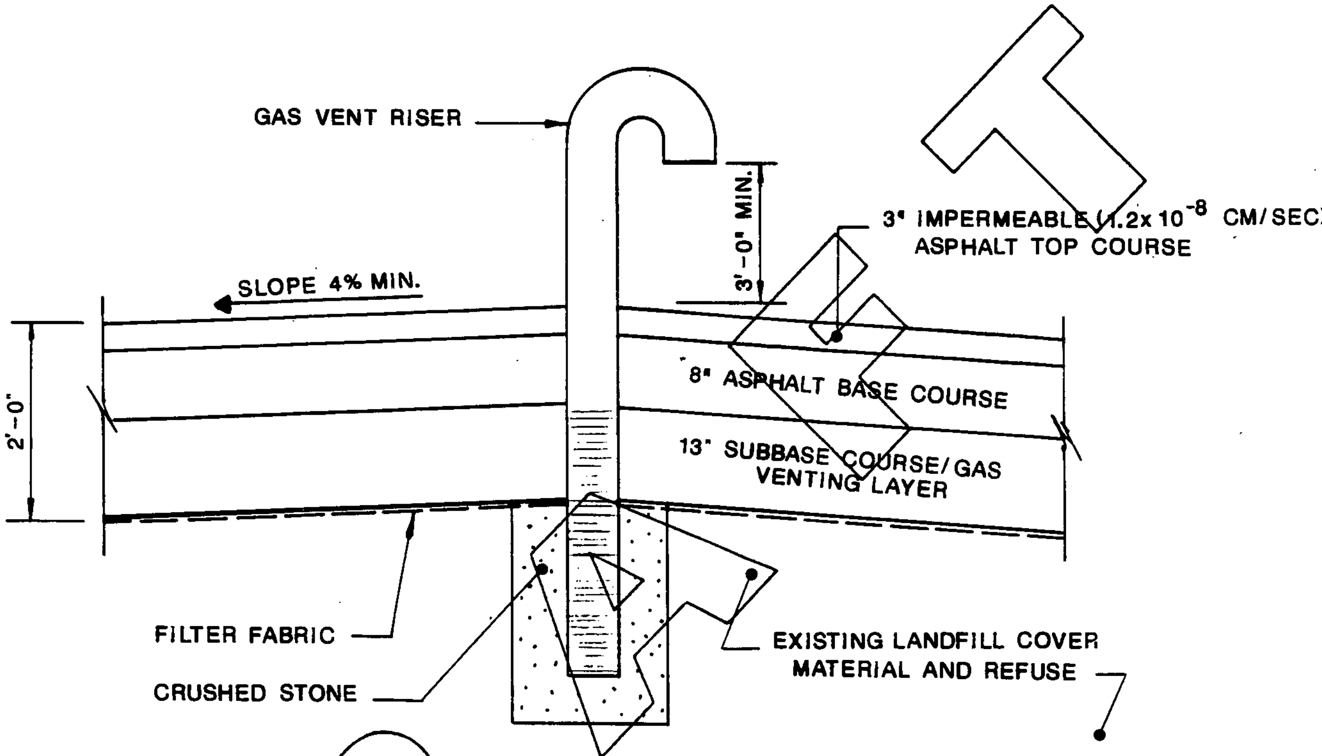
The order of magnitude present worth value for capital, operation, maintenance and monitoring costs for Alternative 2B is 26 million dollars. This cost is sensitive to current pricing of geosynthetic membranes and clean fill.

3.2.5 Alternative No. 2C - 6 NYCRR Part 360 Regulations - Low Permeability Asphalt Cap

Description

Alternative 2C consists of an equivalent low permeability asphalt cap to meet the 6 NYCRR Part 360 regulations. The cap section is shown in Figure 3-4 and consists of the following layers:

- 3" impermeable asphalt (1×10^{-8} cm/sec), placed in two 1-1/2" lifts
- 8" asphalt base course
- 13" subbase course (gas venting layer)
- geosynthetic filter fabric
- clean fill placed over the existing landfill cover material to construct a minimum slope of 4 percent
- gas riser vents extending from within the refuse material to 3'-0" above the final ground surface elevation (minimum of one gas riser vent per acre)
- crushed stone backfill around gas venting risers



6 NYCRR PART 360
LOW PERMEABILITY ASPHALT CAP

FIGURE 3-4

LKB

ALTERNATIVE 2C-CAP SECTION

Effectiveness

The short-term effects that Alternative 2C will have on human health and the environment are all construction related. These effects include increased vehicular traffic from trucks delivering fill and capping materials, minor increases in noise levels due to construction equipment, fugitive dust emissions, and potential exposure to site surface soils and subsurface gases for construction workers. The anticipated construction period for Alternative 2C is expected to be 24 months. Alternative 2C will require the delivery of more fill material (than Alternatives 2A and 2B) to meet proposed grades, since this alternative will require almost no on-site excavation. Encounters with on-site waste material are not anticipated since the proposed cap depth is 2'-0" which should maintain the minor amounts of excavation (required to meet existing grades around the edge of the landfill) within the existing landfill cover material. No excess excavated material will be generated by this alternative.

Mitigation measures to minimize short-term impacts are similar to Alternatives 2A and 2B and include restricting vehicular routes to non-residential areas, limiting construction operation periods to daytime hours when local residents are at work, spraying construction work areas with water to minimize dust generation and air monitoring in the work zone to prevent exposure to gases in concentrations greater than the Occupational Safety & Health Administration (OSHA) limits.

Alternative 2C will have virtually no effect on the reduction of toxicity, mobility and volume of contaminants at the site since no treatment is proposed. However, the proposed asphalt section will reduce future rainwater infiltration and leachate production which will minimize future levels of groundwater contamination from leachate.

Cap efficiencies were calculated for each alternative using NYSDEC procedures. Critical parameters which make for an efficient cap system require that the difference in permeability between the capping material and the overlying cover material is greater than 10^{-4} cm/sec. The greater this difference the more efficient the cap is. The reasoning for this increase in efficiency is that if the overlying material is highly permeable in comparison to the impermeable cap material, water will tend to move through the permeable cover to a discharge point rather than remain on the impermeable cap surface and penetrate the capping material. Since Alternative 2A does not have any material overlying its impermeable asphalt barrier, the difference in permeability between the asphalt and the medium above it (air) is the maximum difference possible, making the cap highly efficient. However, in order to make a comparison to the initial efficiencies of the other alternatives, the assumption was made that similar cover material was overlying the asphalt cap. The resulting initial efficiency of the Alternative 2C cap was 91.4 percent. Since the asphalt cap actually has air above it in lieu of cover material, the initial efficiency of the cap will be even greater.

The Alternative 2C cap section has been designed to provide long-term beneficial effects to human health and the environment, while also possessing properties to ensure its effectiveness and integrity. The asphalt section eliminates exposure to potentially contaminated surface soils, minimizes rainwater infiltration and controls subsurface gas migration. The cap maintains a minimum slope of four percent to promote surface stormwater runoff to reduce stormwater infiltration.

The 3" asphalt cover has a maximum permeability of 1.20×10^{-8} cm/sec, which provides greater impermeability than the 6 NYCRR Part 360 18" layer of 1×10^{-7} cm/sec clay. This impermeability further minimizes rainwater percolation thereby reducing future leachate production and potential groundwater contamination. Subsurface gas migration is controlled through gas ventilation layers and gas vent risers. Landfill gases which rise through the fill material are prohibited from rising further by the asphalt cap. The permeable gas venting layer below the asphalt layer induces gas migration to the gas vent risers which vent the gas into the atmosphere. Gas concentrations at these locations will be monitored on a regular basis to ensure that levels of VOC's and methane are at acceptable limits.

The Alternative 2C cap section is also designed to insure its integrity and maintain its effectiveness over its useful life. The surface layer, which consists of a 3" impermeable cover, is placed in two 1 1/2" lifts with the construction joints staggered to prevent any potential infiltration at the joints. The impermeable asphalt cover is quite effective since its low permeability causes the stormwater to runoff immediately with minimal infiltration. The 3" impermeable asphalt top course with a maximum permeability of 1.20×10^{-8} cm/sec would be equivalent to 25" of 1×10^{-7} cm/sec clay. Since this is greater than the 18" of 1×10^{-7} cm/sec clay required under 6 NYCRR Part 360, the asphalt cover would provide greater effectiveness. In fact, impermeable asphalts are available and in use with permeabilities as low as 3.6×10^{-9} cm/sec (USEPA, 1980). The asphalt cap must be regularly maintained since it is susceptible to cracking through freeze and thaw action. Like any asphalt pavement, it may occasionally need resurfacing to ensure its effectiveness.

However, since the impermeable layer of the cap section is at the surface, it can be regularly inspected to find cracks or flaws which can be immediately mended. This is an advantage over the other alternatives whose clay or synthetic caps cannot be seen from the surface, allowing cracks or punctures to go unrepaired thereby allowing infiltration and drastically reducing their effectiveness.

Implementability

Except for the No Action Alternative, impermeable asphalt cap is the most easily implemented alternative. Although to date the majority of landfills are closed using clay or geosynthetic membranes, it is expected that the proposed asphalt cap will meet or exceed the effectiveness of these traditional capping materials. Impermeable asphalt linings have been used by the U.S. Bureau of Reclamation (USBR) for irrigation canals and water storage systems since 1939 (Asphalt Institute, 1976). During the period from 1947 to 1976 over eight million cubic yards of asphalt were used by the USBR to prevent infiltration in these canals. The 1976 publication by the Asphalt Institute entitled "Asphalt in Hydraulics" reported that several of these linings were in use for over 20 years with no reports of deterioration due to the degradation of the asphalt linings. In summary, the publication identified these linings as an efficient low-cost means of controlling infiltration.

Cost

The order of magnitude present worth value for capital, operation, maintenance and monitoring costs for Alternative 2C is 23 million dollars. This cost is sensitive to current pricing of impermeable asphalt mixes and clean fill.

3.2.6 Alternative No. 2D - RCRA Cap

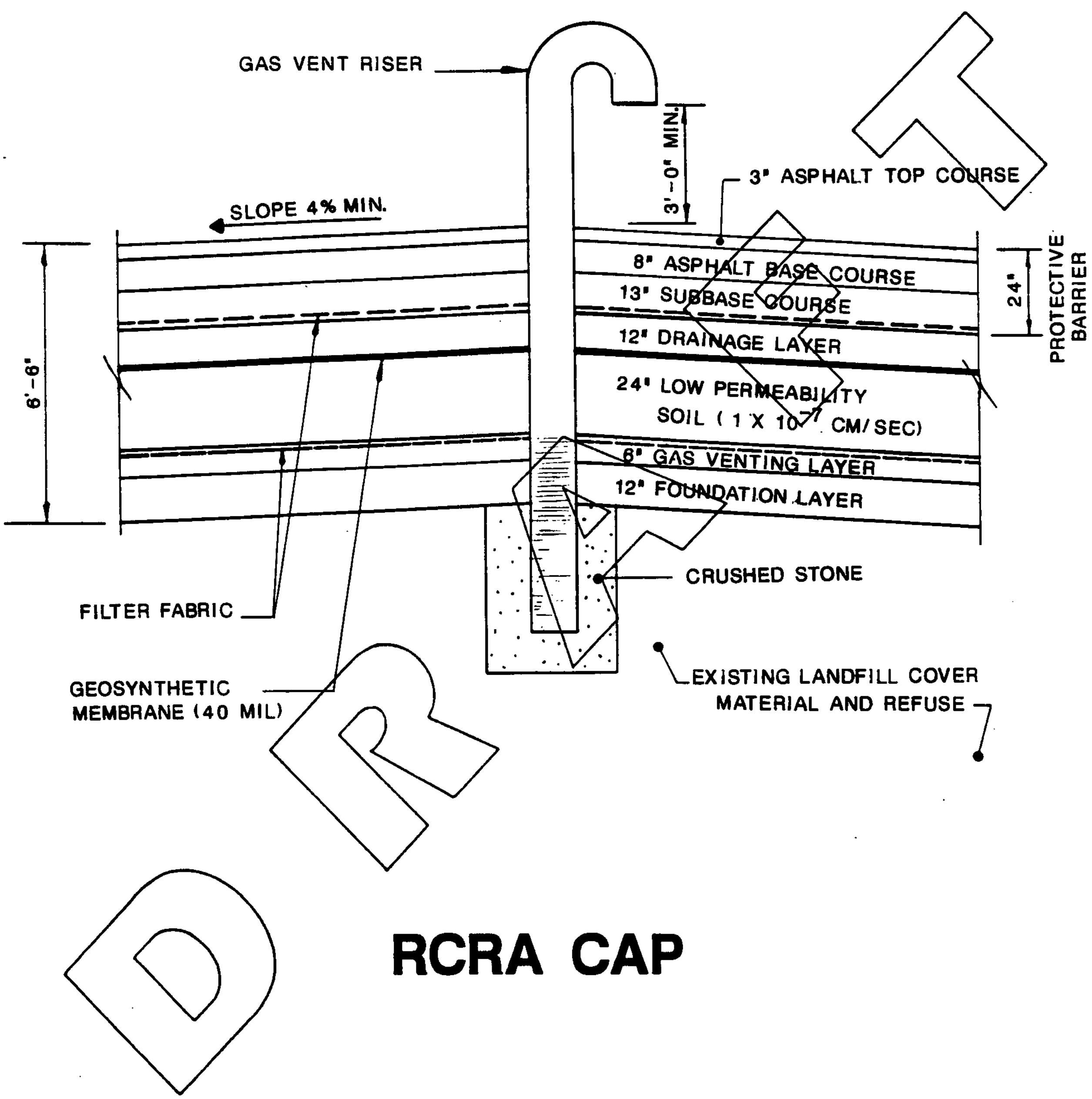
Description

Alternative 2D consists of the RCRA multimedia cap. The minimum cap section is shown in Figure 3-5 and consists of the following layers:

- 24" barrier protection layer consisting of:
  - 3" asphalt top course
  - 8" asphalt base course
  - 13" subbase course
- geosynthetic filter layer
- 12" drainage layer
- geosynthetic membrane (40 mil @ 1×10^{-12} cm/sec)
- 24" low permeability soil layer (1×10^{-7} cm/sec)
- geosynthetic filter layer
- 6" gas venting layer
- 12" minimum clean fill material placed over the existing landfill cover material to construct a minimum slope
- gas riser vents extending from within the refuse material to 3'-0" above the final ground surface elevation
- crushed stone backfill around the gas vent risers

Effectiveness

The short-term effects that Alternative 2D will have on human health and the environment are all construction related. These effects include increased vehicular traffic from trucks delivering fill and capping materials, minor increases in noise levels due to construction equipment, fugitive dust emissions, and exposure to site surface soils and subsurface gases for construction workers.



RCRA CAP

FIGURE 3-5

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ALTERNATIVE 2D-CAP SECTION

In comparison to the other Alternatives, the short-term impacts from Alternative 2D will be more severe, since the 6'-6" RCRA cap is deeper than the others. The construction related impacts for the RCRA cap will be more significant since the anticipated construction period is expected to be 48 months. This construction duration is signficantly longer than the other Alternatives and will therefore have a more significant short-term impact than the other alternatives. In comparison to Alternative 2A, there will be an increase in vehicular traffic caused by the greater number of trucks needed to deliver additional fill material required by the RCRA cap. The most significant construction related impact will be the large amount of excavation required to install the 6'-6" RCRA cap in order to meet existing grades around the edge of the landfill. Cap construction will require the exposure of large amounts of on-site waste material since the on-site landfill cover material will be penetrated. It is anticipated that excavation operations may result in an excess amount of approximately 21,000 CY of excavated material which must be disposed of at a licensed RCRA facility. In addition to the potential health risks to site workers and nearby residents from exposure to these wastes, the cost for disposal of this material is approximately 4.8 million dollars.

Mitigation measures to minimize short-term impacts include restricting vehicular routes to non-residential areas, limiting construction operation periods to daytime hours when local residents are at work, spraying construction work areas with water to minimize dust generation and air monitoring in the work zone to prevent exposure to gases in concentrations greater than the Occupational Safety & Health Administration (OSHA) limits.

Alternative 2D will have virtually no effect on the reduction of toxicity, mobility and volume of contaminants at the site since no treatment is proposed. However, the proposed capped section will reduce future rainwater infiltration and leachate production which will minimize future levels of groundwater contamination from leachate.

Cap efficiencies were calculated for each alternative using NYSDEC procedures. The initial cap efficiency of the clay-geosynthetic membrane layer of Alternative 2D is 97.0 percent, which is greater than 90 percent as stipulated in the ARAR's. The installation of the asphalt surface treatment will substantially increase this efficiency since the asphalt cover will limit the amount of infiltration that reaches the clay-geosynthetic membrane cap to less than 10 percent of the rainwater which falls on the site. This added protection will increase the total cap efficiency to 99.70 percent (i.e. 97.0 percent efficiency of the 10 percent of water which reaches the multi-media cap).

The Alternative 2D section is designed to provide long-term beneficial effects to human health and the environment, while also possessing properties to ensure its effectiveness and integrity. The 6'-6" cap section eliminates exposure to potentially contaminated surface soils, minimizes rainwater infiltration and controls subsurface gas migration. The 24" barrier protection layer consists of a 3" bituminous asphalt concrete top course on an 8" asphalt base course and a 13" subbbase course. Utilizing asphalt as a surface treatment over the cap section will significantly increase the efficiency of the cap section. The asphalt cover material, having a runoff coefficient of 0.9 to 1.0, will promote surface stormwater runoff while reducing infiltration to less than 10 percent of the precipitation that falls on the site. In addition, the 24" clay layer in combination with the geosynthetic membrane further minimizes rainwater percolation due to their maximum permeabilities of 1×10^{-7} cm/sec and 1×10^{-12} cm/sec, respectively. This double capped system significantly reduces future leachate production and potential groundwater contamination.

Subsurface gas migration is controlled through gas ventilation layers and gas vent risers. Landfill gases which rise through the fill material are prohibited from rising further by the clay cap. The permeable gas venting layer below the clay layer induces gas migration to the gas vent risers which vent the gas into the atmosphere. Gas concentrations at these locations will be monitored on a regular basis to ensure that levels of VOC's and methane are at acceptable limits.

The Alternative 2D cap section is also designed to insure its integrity and maintain its effectiveness over its useful life. The surface layer consists of a total of 36" of cover material to create a protective barrier over the clay cap. Since asphalt will be used in lieu of a vegetative cover, there will be no potential for roots penetrating the synthetic membrane and clay cap or for animals burrowing through the cap, reducing the risk of cap failure. In addition, the 24" clay cap and geosynthetic membrane provide the least opportunity of failure of all alternatives. While clay is susceptible to cracking due to freezing and landfill settlement, it has self sealing properties which enable it to adjust to these dynamic elements. Although utilizing both the clay barrier layer and the geosynthetic membrane minimizes the risk of infiltration, the geosynthetic membrane is still susceptible to punctures and tears. Unlike the clay layer, the geosynthetic membrane does not possess self sealing properties. Once the membrane is punctured, however, the hole or tear will tend to be sealed by the low permeability clay beneath it. Annual inspections of the protective barrier layer of the cover system will be required to identify potential areas in need of repair.

Although geosynthetic membranes have been used as both caps and liners at landfills, they are a relatively recent technology that have generally not been in place for more than 30 years. The membrane may therefore need to be replaced at some time in the future.

Implementability

Clay cap sections similar to Alternative 2D are used at RCRA hazardous waste sites for closure operations. Clay caps and geosynthetic membranes have been proven as an acceptable, effective and reliable means of eliminating various human health and environmental exposure pathways. The RCRA cap is not as easily implemented as the 6 NYCRR Part 360 caps. Services and materials for RCRA cap installations are readily available. Although $1x10^{-7}$ cm/sec clay is available, it is no longer available locally. RCRA caps also require higher levels of maintenance than 6 NYCRR Part 360 caps.

Cost

Costs for the RCRA cap are much greater than the costs for the 6 NYCRR Part 360 caps. The order of magnitude present worth value for capital, operation, maintenance and monitoring costs for Alternative 2D is 45 million dollars. This cost is sensitive to current availability and pricing of clay, geosynthetic membranes and hazardous waste disposal. Current costs for obtaining clay have been quite high ranging around $90/cubic yard.

3.2.7 Summary of Remedial Alternatives

This summary of remedial alternatives briefly discusses the results of the alternative screening evaluation. All of the capping alternatives, consistent with the NYSDEC closure requirements, would require post-closure operation and maintenance to operate and maintain the various caps, drainage structures and gas venting systems. In addition, a gas and groundwater monitoring program would be required, and institutional controls will be implemented at the Landfill property to ensure the integrity of the cap. Several of the alternatives have been retained for detailed analysis.

<u>Alternative 1 - No Action</u>

This alternative is retained for detailed analysis in accordance with NCP requirements. Although this alternative does not meet the remedial action objectives, it will be retained for comparison purposes. Order of magnitude cost: 1 million dollars.

<u>Alternative 2A - 6 NYCRR Part 360 Regulations - Low Permeability Soil Cap</u>

This alternative is retained for detailed analysis. It is most applicable for landfill closure operations. Alternative 2A meets the remedial action objectives and will provide long-term effectiveness by reducing the potential for future leachate production and subsurface gas migration and eliminating contact with contaminated surface soils. This alternative will require compliance with stringent closure and post-closure regulations. Order of magnitude cost: 33 million dollars. Construction period: 36 months.

<u>Alternative 2B - 6 NYCRR Part 360 Regulations - Geosynthetic Membrane Cap</u>

This alternative is retained for detailed analysis. It is most applicable for landfill closure operations. Alternative 2B meets the remedial action objectives and will provide long-term effectiveness by reducing the potential for future leachate production and subsurface gas migration and eliminating contact with contaminated surface soils. This alternative will require compliance with stringent closure and post-closure requirements. Order of magnitude cost: 26 million dollars. Construction period: 30 months.

Alternative 2C - 6 NYCRR Part 360 Regulations - Low Permeabilty Asphalt Cap

This alternative is retained for detailed analysis. It is most applicable for landfill closure operations. Alternative 2C meets the remedial action objectives and will provide long-term effectiveness by reducing the potential for future leachate production and subsurface gas migration and eliminating contact with contaminated surface soils. This alternative will require compliance with stringent closure and post-closure requirements. Order of magnitude cost: 23 million dollars. Construction period: 24 months.

Alternative 2D - RCRA Cap

This alternative is eliminated from further consideration since it meets four of the CERCLA waiver criteria listed below (Note: only one criteria needs to be met to eliminate an alternative):

- Alternative 2D will provide a greater risk to human health and the environment (CERCLA waiver criteria No. 2), since its implementation will require the exposure of large amounts of on-site waste material and the disposal of approximately 21,000 CY of excess excavated waste material.

- Although Alternative 2D is feasible, it's present worth cost of $45 million dollars makes it technically impractical (CERCLA waiver criteria No. 2), since it complies with the requirement that "a remedial alternative that is feasible might be deemed technically impracticable if it could only be accomplished at an inordinate cost" (USEPA, 1988b).

- The implementation of one of the 6 NYCRR Part 360 caps in lieu of the RCRA Cap will achieve an equivalent standard of performance (CERCLA waiver criteria No. 4) since the other caps will achieve (1) beneficial results in a shorter amount of time (RCRA cap construction period is 48 months); (2) a comparable degree of protection of health, welfare and the environment; (3) a comparable level of performance and (4) comparable long-term reliability.

- Construction of the RCRA cap at this site would be an inconsistent application of State requirements (CERCLA waiver criteria No. 5), since the NYSDEC has previously implemented the use of 6 NYCRR Part 360 caps at other National Priorities List (NPL) inactive landfill sites located in the general vicinity of the Syosset Landfill.

Conclusions

In conclusion, the Applicable Relevant and Appropriate Requirements (ARAR's) to be met for waste facility closure are the New York State 6 NYCRR Part 360 regulations for landfill closure. Alternatives 2A, 2B and 2C which have been retained thus far meet these requirements.

SECTION 4

DETAILED ANALYSIS OF ALTERNATIVES

This section provides a detailed analysis of the remedial alternatives which have been retained thus far. Each alternative is now analyzed utilizing the nine evaluation criteria set forth in the National Contingency Plan for analyzing remedial alternatives. A comparison of the alternatives is also performed to identify the key tradeoffs between them. This analytical approach is designed to provide sufficient information to adequately compare the alternatives to select an appropriate remedial action for the site.

4.1 INTRODUCTION

The USEPA developed nine evaluation criteria to address CERCLA requirements regarding remedial actions. The nine criteria, in order of consideration, are as follows:

1. Overall Protection of Human Health and the Environment - This criteria assesses the ability of an alternative to achieve and maintain the protection of human health and the environment.

2. Compliance with ARAR's - This criteria describes how the alternative complies with the ARAR's, whether a waiver is required and how it is justified. In addition, this criteria evaluates if the alternative meets guidelines designated as "to be considered" by lead and support agencies.

3. Long-term Effectiveness - This criteria evaluates the long-term effectiveness of each alternative and their ability to maintain the protection of human health and the environment once implemented.

4. Reduction of Toxicity, Mobility and Volume - This criteria evaluates the anticipated performance of the specific treatment technologies which an alternative may employ.

5. Short-term Effectiveness - This criteria examines the effectiveness of each alternative in protecting human health and the environment during construction and implementation of the remedial action.

6. Cost Effectiveness - This criteria evaluates the capital, operation and maintenance cost of each alternative. Costs are compared utilizing the present worth value of costs for each alternative based on a 10 percent discount rate over a 30 year period of operation. EPA guidance documents stipulate that Feasibility Study cost estimates are generally expected to provide an accuracy of +50 percent to -30 percent (USEPA, 1988a).

7. Community Acceptance - This criteria assesses the community's apparent preferences among, or concerns about, the alternatives.

8. State Acceptance - This criteria assesses the State's apparent preferences among, or concerns about, alternatives.

9. Implementability - This criteria evaluates the technical and administrative feasibility of alternatives and the availability of materials and services.

4.2 INDIVIDUAL ANALYSIS OF ALTERNATIVES

This section discusses how each of the remedial action alternatives comply with the nine evaluation criteria. Those items which are common to each alternative (as discussed in Section 3), will not be addressed in the detailed analysis of alternatives. These items include site preparation, site drainage system, landscape buffer and the use of vegetative cover material over the proposed cap areas where asphalt is not required (See Figure 3-1).

4.2.1 Alternative No. 1 - No Action

4.2.1.1 Description

Implementation of the No Action Alternative would retain the site in its existing condition. Continued monitoring of groundwater and subsurface gas would be required to follow the extent of future contamination.

4.2.1.2 Individual Criteria Assessment

The following paragraphs discuss how the No Action Alternative complies with the nine CERCLA evaluation criteria. An evaluation summary for the No Action Alternative is provided in Table 4-1.

Overall Protection of Human Health and Environment

The No Action Alternative would retain the site in its current condition. Although the site does not pose a threat to human health or the environment in its current state, exposure to site surface soils, the migration of subsurface gases and leachate generation would continue.

TABLE 4-1

INDIVIDUAL ALTERNATIVE ANALYSIS
ALTERNATIVE NO. 1 - NO ACTION

DESCRIPTION

The No Action Alternative consists of leaving the site in its current condition.

INDIVIDUAL CRITERIA ASSESSMENT

Overall Protection of Human Health and the Environment

- This alternative is not protective of human health since it does not meet the remedial action objectives.
- The site in its current condition does not pose a risk to the environment.

Compliance with ARAR's

- Does not comply with landfill closure regulations.

Long-Term Effectiveness

- Not effective in controlling future contaminant releases and migration.
- Leachate production would continue.
- Potential for off-site subsurface gas migration would continue.
- Groundwater and gas monitoring would be required.

Reduction of Toxicity, Mobility and Volume

- Not applicable since no treatment is involved.

Short-Term Effectiveness

- This alternative does not have any short-term impacts since no construction is involved.

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Table 4-1 (Cont'd.)

Cost Effectiveness

- Capital Cost: $ 0
- Annual Maintenance & Monitoring Cost: $ 115,000.
- Estimated Present Worth: $1,084,000

Community Acceptance

- The No Action Alternative is expected to be opposed of by the local community.

State Acceptance

- Does not comply with New York State 6 NYCRR Part 360 Regulations for landfill closures.

Implementability

- Technically feasible but unreliable.

- Not administratively feasible. Does not comply with New York State 6 NYCRR Part 360 Regulations for landfill closure.

- Services and materials readily available.

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Compliance with ARAR's

The No Action Alternative does not comply with the current landfill closure regulations and other site ARAR's.

Long-Term Effectiveness

The No Action Alternative does not provide long-term effectiveness since it does not meet the remedial action objectives. This alternative is not effective in controlling future contaminant releases and migration. Continued monitoring of groundwater and subsurface gas would be required to track future levels of contamination from the site.

Reduction of Toxicity, Mobility and Volume

The reduction of toxicity, mobility and volume is not applicable since this alternative does not propose any treatment technologies.

Short-Term Effectiveness

This alternative would not have any short-term impacts since no construction activities are included in the No Action Alternative.

Cost Effectiveness

The No Action Alternative does not require any capital costs. All costs to be incurred would be for continued monitoring of groundwater and subsurface gas. The related annual costs are estimated at $115,000 for a present worth value of $1,084,000. It is likely that the annual costs for this alternative would increase over the years as leachate generation continues.

Community Acceptance

It is expected that the local community would oppose the No Action Alternative.

State Acceptance

The No Action Alternative does not comply with the current New York State 6 NYCRR Part 360 regulations for landfill closure.

Implementability

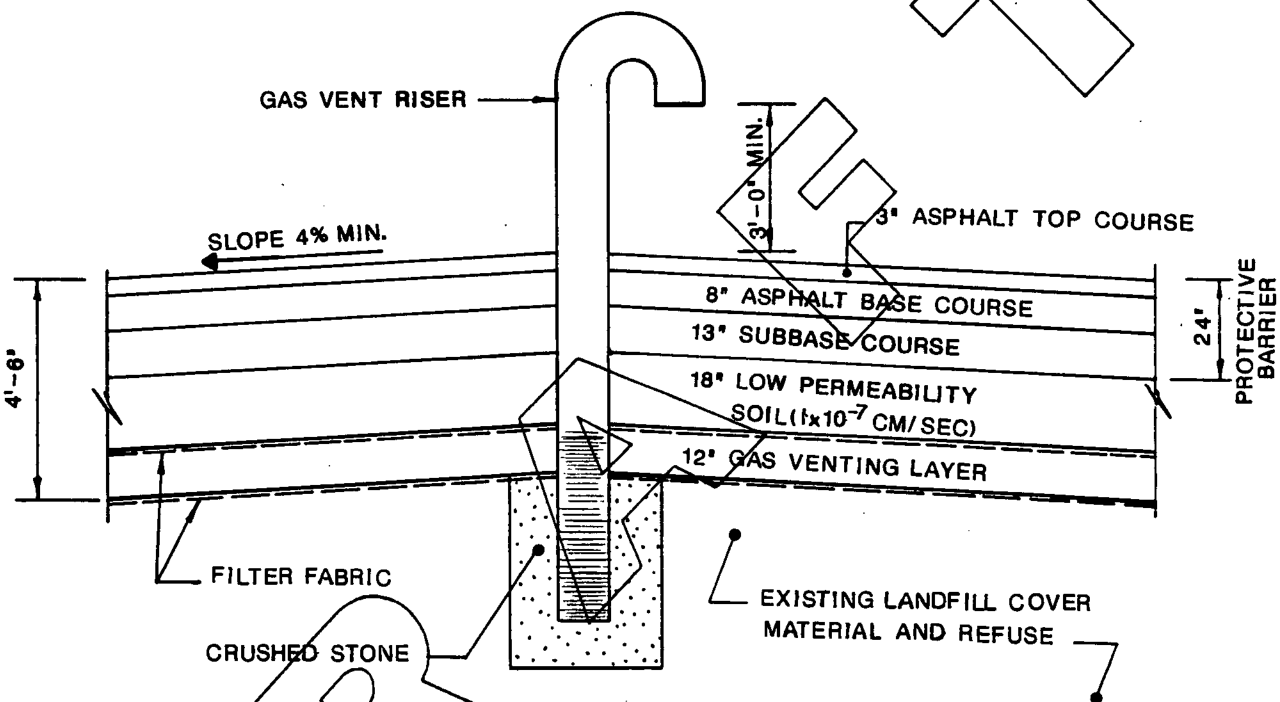
The No Action Alternative is technically feasible, but does not meet the remedial action objectives. The No Action Alternative is not administratively feasible since it does not comply with the New York State 6 NYCRR Part 360 regulations for landfill closure. Services and materials to implement this alternative are readily available.

4.2.2 Alternative No. 2A - 6 NYCRR Part 360 Regulations - Low Permeability Soil Cap

4.2.2.1 Description

Alternative 2A consists of the 6 NYCRR Part 360 low permeability soil cap for landfill closure. The minimim cap section is shown in Figure 4-1 and consists of the following layers:

- 24" barrier protection layer consisting of:
  - 3" asphalt top course
  - 8" asphalt base course



6 NYCRR PART 360
LOW PERMEABILITY SOIL CAP

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FIGURE 4-1

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ALTERNATIVE 2A–CAP SECTION

- 13" subbase course
- 18" low permeability soil layer (1×10^{-7} cm/sec)
- two layers of geosynthetic filter fabric
- 12" gas venting layer
- clean fill placed over the existing landfill cover material to construct a minimum slope of 4 percent
- gas riser vents extending from within the refuse material to 3'-0" above the final ground surface elevation (minimum of one gas riser vent per acre)
- crushed stone backfill around gas venting risers

4.2.2.2 Individual Criteria Assessment

The following paragraphs discuss how Alternative 2A complies with the nine CERCLA evaluation criteria. An evaluation summary for Alternative 2A is provided in Table 4-2.

Overall Protection of Human Health and the Environment

Alternative 2A meets all of the on-site remedial action objectives, which include preventing future contact with on-site surface soils, reducing subsurface gas migration and minimizing future leachate production. Alternative 2A will be protective of human health and the environment since the 4'-6" cap section will eliminate exposure to potentially contaminated on-site surface soils, minimize rainwater infiltration and control subsurface gas migration.

The low permeability soil of Alternative 2A provides an initial cap efficiency of 90.4 percent, which is higher than the 90 percent minimum efficiency stipulated in the ARAR's. The installation of the asphalt

TABLE 4-2

INDIVIDUAL ALTERNATIVE ANALYSIS
ALTERNATIVE NO. 2A - 6 NYCRR PART 360 REGULATIONS
LOW PERMEABILITY SOIL CAP

DESCRIPTION

The Alternative 2A cap section consists of a 24" protective barrier surface layer (3" asphalt top course, 8" asphalt base course and 13" subbase course), an 18" low permeability (1x10 $^{-7}$ cm/sec) soil layer, a 12" gas venting layer, two layers of filter fabric, gas vent risers and sufficient clean fill material to construct a minimum slope of 4 percent to promote stormwater drainage.

INDIVIDUAL CRITERIA ASSESSMENT

Overall Protection of Human Health and the Environment

- Eliminates future exposure to site surface soils.
- Minimizes future subsurface gas migration.
- Minimizes future leachate production.

Compliance with ARAR's

- Complies with New York State 6 NYCRR Part 360 landfill closure regulations.
- Complies with ARAR of 90.0 percent reduction in stormwater infiltration.
- Complies with New York State air quality guidelines, although occasional monitoring of gas emissions may be required.

Long-Term Effectiveness

- Clay layer maintains an efficiency of 90.4 percent.
- Use of asphalt surface treatment will increase total cap efficiency to 99.04 percent.
- Minimizes future subsurface gas migration.
- Proven technology for landfill closure.

Table 4-2 (Cont'd.)

- Provides minimum opportunity for cap failure due to self sealing properties of clay.

- Asphalt surface eliminates potential for cap failure due to burrowing animals and deep root penetration.

- Annual inspections of the protective barrier layer of the cover system is required.

- Occasional monitoring of gas emissions required.

Reduction of Toxicity, Mobility and Volume

- Not applicable since no treatment is involved.

Short-Term Effectiveness

- Impacts to surrounding community limited to increased vehicular traffic, minor increase in noise levels, fugitive dust emissions. Mitigating measures include restricting vehicular routes, hours of operation, and spraying water for dust control.

- Impacts to on-site workers include fugitive dust emissions, potential exposure to on-site surface soils. Mitigating measures include spraying water for dust control, air monitoring and the use of respiratory protection equipment if necessary.

- Anticipated duration of construction is 36 months.

Cost Effectiveness

- Capital Cost:	$ 30,279,000
- Annual Maintenance & Monitoring Cost:	$ 280,000
- Estimated Present Worth:	$ 32,920,000

Community Acceptance

- Alternative 2A is expected to be approved by the local community.

State Acceptance

- Alternative 2A complies with the New York State 6 NYCRR Part 360 landfill closure regulations.

Table 4-2 (Cont'd.)

Implementability

- Technically feasible. Low permeability soils are a reliable and frequently used technology for landfill closure.
- Easily implemented. Materials and services are available.
- Administratively feasible. Alternative 2A should have minimal requirements for NYSDEC approval.

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surface treatment will substantially increase this efficiency since the asphalt cover will limit the amount of infiltration that reaches the clay cap to less than 10 percent of the rainwater which falls on the site. This added protection will increase the total cap efficiency to 99.04 percent (i.e. 90.4 percent efficiency of the 10 percent of water which reaches the cap). Therefore, although leachate production will be significantly reduced by 99.04 percent over existing conditions, some leachate will continue to be generated.

Alternative 2A will provide similar levels of protection in regard to subsurface gas migration as the other alternatives, since the same gas control technologies will be utilized for all alternatives.

Compliance with ARAR's

Alternative 2A complies with the New York State 6 NYCRR regulations for landfill closure and the New York State guidelines for ambient air quality.

Long-Term Effectiveness

Alternative 2A provides a cap efficiency of 99.04 percent. This cap efficiency will drastically reduce the amount of future leachate production at the site.

Alternative 2A will minimize future subsurface gas migration. The proposed passive gas control system will be monitored to ensure its compliance with air quality ARAR's. The system will also be designed so that it is capable of being converted to an active gas collection system should future treatment be required.

Alternative 2A will also eliminate the potential for contact with on-site surface soils.

The Alternative 2A cap section is a reliable means of meeting these remedial action objectives. Low permeability soil caps are a proven technology for landfill closures and have been frequently employed. The 18 inch low permeability clay cap is a reliable barrier which provides a minimum opportunity for failure. While clay is susceptible to cracking due to freezing and landfill settlement, it has self sealing properties which enable it to adjust to these dynamic elements. The 24 inch protective barrier consists of an asphalt top course and base course in lieu of a vegatative cover. The proposed surface treatment will eliminate the potential for cap failure due to burrowing animals or root penetration. Annual inspections of the protective barrier layer of the cover system will be required to identify areas in need of repair.

Reduction of Toxicity, Mobility and Volume

The reduction of toxicity, mobility and volume is not applicable since this alternative does not propose any treatment technologies.

Short-Term Effectiveness

It is anticipated that construction activities will not result in emission of hazardous substances which could impact the surrounding communities. The short-term construction related effects include increased vehicular traffic from trucks delivering fill and capping materials, minor increases in noise levels due to construction equipment, fugitive dust emissions, and potential exposure to site surface soils and subsurface gases for construction workers. Encounters with on-site waste material should be minimal since there is approximately 6 inches to 4 feet of existing cover material over the refuse. All excavated materials will be left on-site and used as fill material. There will be no excess excavated material for this alternative.

Short-term impacts can be minimized by restricting vehicular routes to non-residential areas, limiting construction operation periods to daytime hours when local residents are at work, spraying work areas with water to minimize dust generation and air monitoring in the work zone to prevent exposure to gases in concentrations greater than the Occupational Safety & Health Administration (OSHA) limits. The anticipated duration of construction activities for this alternative is expected to be 36 months, The actual duration of construction will be effected by the time of year in which it commences, the weather and the availability, and/or source of construction materials.

Cost Effectiveness

The estimated capital, cost annual operation and maintenance cost, and present worth cost for Alternative 2A are $30,279,000, $280,000 and $32,920,000, respectively. These costs are sensitive to the availability and costs for clean fill material, low permeability clay, and asphalt.

Community Acceptance

It is anticipated that the local community will approve of Alternative 2A.

State Acceptance

Alternative 2A complies with the New York State 6 NYCRR Part 360 regulations for landfill closure.

Implementability

Clay cap sections have been frequently used during landfill closure operations, and have been proven as an acceptable, effective and reliable means of waste contaminant. They are easily implemented with services and materials which are readily available. Although 1×10^{-7} cm/sec clay is available, it is no longer available locally. Clay caps require moderate levels of maintenance in comparison to other closure technologies. The use of 6 NYCRR Part 360 clay caps require minimal requirements for NYSDEC approval, thereby leading to timely implementation of this remedial action alternative.

4.2.3 Alternative No. 2B - 6 NYCRR Part 360 Regulations - Geosynthetic Membrane Cap

4.2.3.1 Description

Alternative 2B consists of the 6 NYCRR Part 360 geosynthetic membrane cap for landfill closure. The minimum cap section is shown in Figure 4-2 and consists of the following layers:

- 24" barrier protection layer consisting of:
  - 3" asphalt top course
  - 8" asphalt base course
  - 13" subbase course

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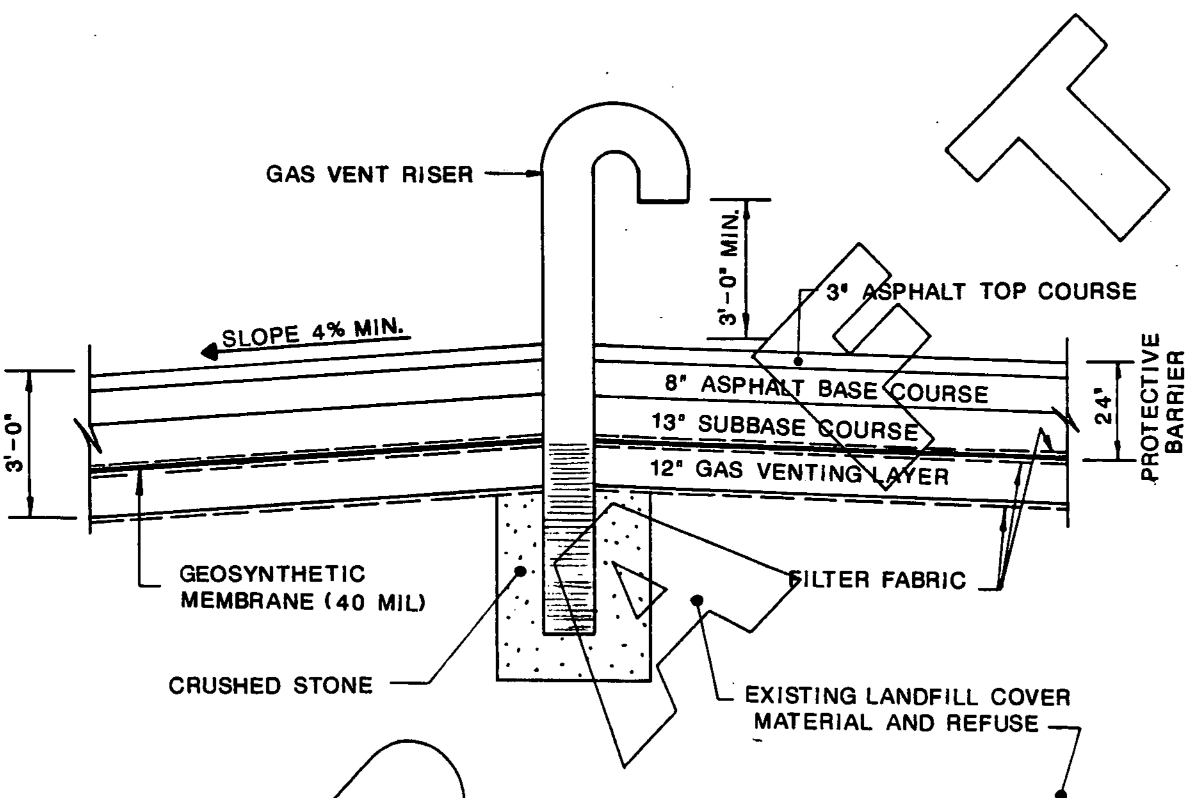

6 NYCRR PART 360 GEOSYNTHETIC CAP

FIGURE 4-2

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ALTERNATIVE 2B-CAP SECTION

- geosynthetic membrane (40 mil @ $1x10^{-12}$ cm/sec)
- three layers of geosynthetic filter fabric
- 12" gas venting layer
- clean fill placed over the existing landfill cover material to construct a minimum slope of 4 percent
- gas riser vents extending from within the refuse material to 3'-0" above the final ground surface elevation (minimum of one gas riser vent per acre)
- crushed stone backfill around gas venting risers

4.2.3.2 Individual Criteria Assessment

The following paragraphs discuss how Alternative 2B complies with the nine CERCLA evaluation criteria. An evaluation summary for Alternative 2B is provided in Table 4-3.

Overall Protection of Human Health and the Environment

Alternative 2B meets all of the on-site remedial action objectives, which include preventing future contact with on-site surface soils, reducing subsurface gas migration and minimizing future leachate production. Alternative 2B will be protective of human health and the environment since the 3'-0" cap section will eliminate exposure to potentially contaminated on-site surface soils, minimize rainwater infiltration and control subsurface gas migration.

The geosynthetic membrane of Alternative 2B provides an initial cap efficiency of 94.3 percent, which is higher than the 90 percent minimum efficiency stipulated in the ARAR's. The installation of the asphalt surface treatment will substantially increase this efficiency since the

TABLE 4-3

INDIVIDUAL ALTERNATIVE ANALYSIS
ALTERNATIVE NO. 2B - 6 NYCRR PART 360 REGULATIONS
GEOSYNTHETIC MEMBRANE CAP

DESCRIPTION

The Alternative 2B cap section consists of a 24" protective barrier surface layer (3" asphalt top course, 8" asphalt base course and 13" subbase course), a geosynthetic membrane (40 mil @ $1x10^{-12}$ cm/sec) a 12" gas venting layer, three layers of filter fabric, gas vent risers and sufficient clean fill material to construct a minimum slope of 4 percent to promote stormwater drainage.

INDIVIDUAL CRITERIA ASSESSMENT

Overall Protection of Human Health and the Environment

- Eliminates future exposure to site surface soils.
- Minimizes future subsurface gas migration.
- Minimizes future leachate production.

Compliance with ARAR's

- Complies with New York State 6 NYCRR Part 360 landfill closure regulations.
- Complies with ARAR of 90.0 percent rejection or contaminant of surface precipitation.
- Complies with New York State air quality guidelines, although occasional monitoring of gas emissions may be required.

Long-Term Effectiveness

- Geosynthetic membrane layer maintains an efficiency of 94.3 percent.
- Use of asphalt surface treatment will increase efficiency to 99.43 percent.
- Minimizes future subsurface gas migration.
- Proven technology for landfill closure.

Table 4-3 (Cont'd.)

- The long-term life of geosynthetic membranes are unknown.

- Geosynthetic membranes are susceptible to failure due to punctures and tears both during and after construction.

- Asphalt surface eliminates potential for cap failure due to burrowing animals and deep root penetration.

- Annual inspections of the protective barrier layer of the cover system is required.

- Occasional monitoring of gas emissions required.

Reduction of Toxicity, Mobility and Volume

- Not applicable since no treatment is involved.

Short-Term Effectiveness

- Impacts to surrounding community limited to increased vehicular traffic, minor increase in noise levels, fugitive dust emissions. Mitigating measures include restricting vehicular routes, hours of operation, and spraying water for dust control.

- Impacts to on-site workers include fugitive dust emissions, potential exposure to on-site surface soils. Mitigating measures include spraying water for dust control, air monitoring and the use of respiratory protection equipment if necessary.

- Anticipated duration of construction is 30 months.

Cost Effectiveness

- Capital Cost:	$ 24,070,000
- Annual Maintenance & Monitoring Cost:	$ 222,000
- Estimated Present Worth:	$ 26,158,000

Community Acceptance

- Alternative 2B is expected to be approved by the local community.

Table 4-3 (Cont'd.)

State Acceptance

- Alternative 2B complies with the New York State 6 NYCRR Part 360 landfill closure regulations.

Implementability

- Technically feasible. Geosynthetic membrane covers are a reliable and frequently used technology for landfill closure.

- Easily implemented. Materials and services are available.

- Administratively feasible. Alternative 2B should have minimal requirements for NYSDEC approval.

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asphalt cover will limit the amount of infiltration that reaches the geosynthetic membrane cap to less than 10 percent of the rainwater which falls on the site. This added protection will increase the total cap efficiency to 99.43 percent (i.e. 94.3 percent efficiency of the 10 percent of water which reaches the cap). Therefore, although leachate production will be significantly reduced by 99.43 percent over existing conditions, some leachate will continue to be generated.

Alternative 2B will provide similar levels of protection in regard to subsurface gas migration as the other alternatives, since the same gas control technologies will be utilized for all alternatives.

Compliance with ARAR's

Alternative 2B complies with the New York State 6 NYCRR regulations for landfill closure and the New York State guidelines for ambient air quality.

Long-Term Effectiveness

Alternative 2B provides a total cap efficiency of 99.43 percent. This cap efficiency will significantly reduce the amount of future leachate production at the site.

Alternative 2B will minimize future subsurface gas migration. The proposed passive gas control system will be monitored to ensure its compliance with air quality ARAR's. The system will also be designed so that it is capable of being converted to an active gas collection system should future treatment be required.

Alternative 2B will also eliminate the potential for contact with on-site surface soils.

The Alternative 2B cap section is a reliable means of meeting these remedial action objectives. Geosynthetic membrane caps are a proven technology for landfill closures and have been frequently used for landfill caps and liner systems. Although geosynthetic membranes are not susceptible to cracking due to freezing, they are susceptible to punctures and tears both during installation and following installation due to differential landfill settlement. Unlike a clay cap, the geosynthetic membrane does not possess self sealing properties. Once the membrane is punctured a hole or tear will remain, enabling water to seep into the landfill reducing the cap efficiency. The 24 inch protective barrier consists of an asphalt top course and base course in lieu of a vegetative cover. The proposed surface treatment will eliminate the potential for cap failure due to burrowing animals or root penetration. Annual inspections of the protective barrier layer of the cover system will be required to identify areas in need of repair.

Reduction of Toxicity, Mobility and Volume

The reduction of toxicity, mobility and volume is not applicable since this alternative does not propose any treatment technologies.

Short-Term Effectiveness

It is anticipated that construction activities will not result in emission of hazardous substances which could impact the surrounding communities. The short-term construction related effects are similar to Alternative 2A and include minor increases in noise levels due to construction equipment, fugitive dust emissions, and potential exposure to site surface soils and subsurface gases for construction workers. The anticipated duration of construction activities for this alternative is expected to be 30 months. The actual duration of construction will be effected by the time of year in which it commences, the weather and the availability or source of construction materials. The shorter construction period will produce less significant short-term impacts for this Alternative. Although Alternative 2B does not require the delivery of clay material to the site, vehicular traffic will be slightly increased (in comparison to Alternative 2A) since this alternative requires the placement of more fill material to meet the proposed site grades. In addition, encounters with on-site waste material will be less than Alternative 2A since less excavation is required. No excess excavated material will be generated by this alternative.

Short-term impacts can be minimized similar to Alternative 2A by restricting vehicular routes to non-residential areas, limiting construction operation periods to daytime hours when local residents are at work, spraying construction work areas with water to minimize dust generation and air monitoring in the work zone to prevent exposure to gases in concentrations greater than the Occupational Safety & Health Administration (OSHA) limits.

Cost Effectiveness

The estimated capital cost, annual operation and maintenance cost and present worth cost for Alternative 2B are $24,070,000, $222,000 and $26,158,000, respectively. These costs are sensitive to the availability and costs for clean fill material, geosynthetic membrane and asphalt.

Community Acceptance

It is anticipated that the local community will approve of Alternative 2B.

State Acceptance

Alternative 2B complies with the New York State 6 NYCRR Part 360 regulations for landfill closure.

Implementability

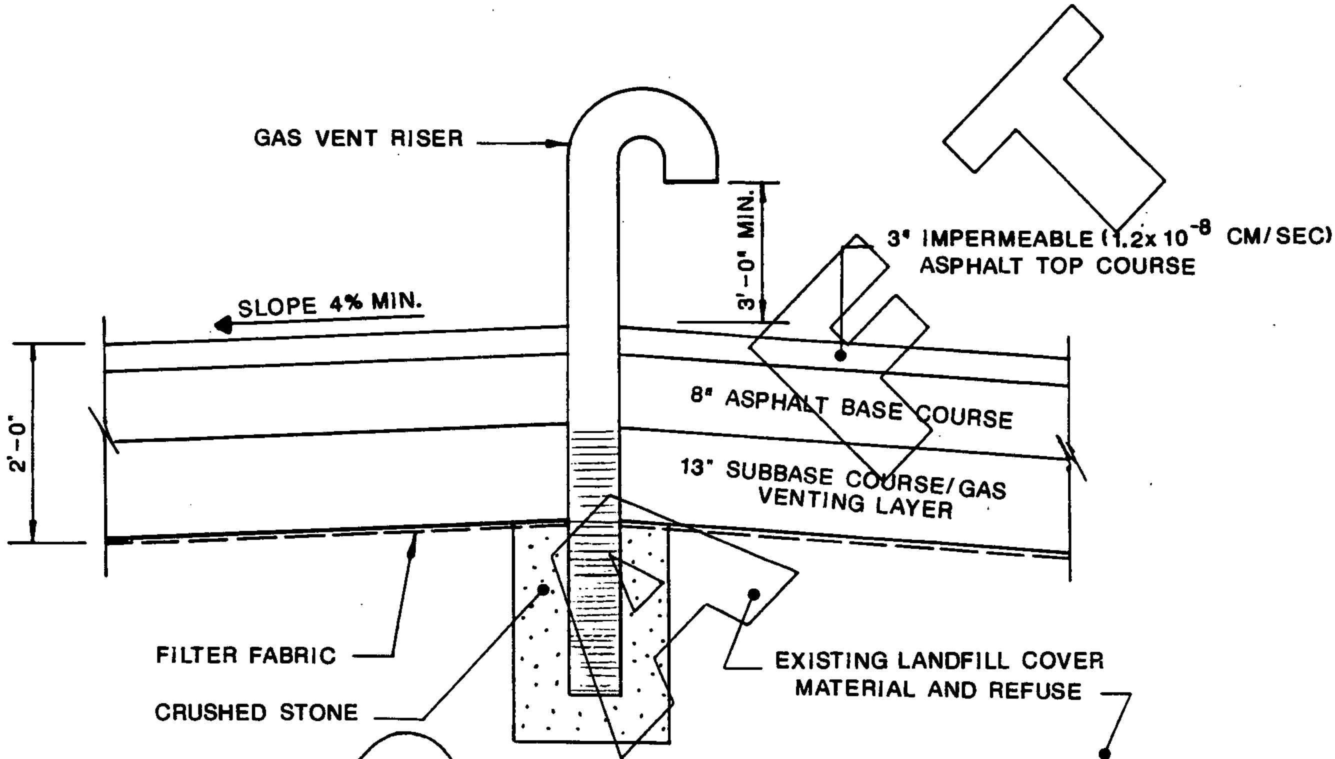
Geosynthetic membranes have been used over the years for both landfill closure caps and landfill liner systems. Geosynthetic caps have been proven as an acceptable, effective and reliable means of waste containment. They are easily implemented with services and materials which are readily available. The use of 6 NYCRR Part 360 synthetic caps also require minimal requirements for NYSDEC approval, thereby leading to timely implementation of this remedial action alternative.

4.2.4 Alternative No. 2C - 6 NYCRR Part 360 Regulations - Low Permeability Asphalt Cap

4.2.4.1 Description

Alternative 2C consists of an equivalent low permeability asphalt cover to meet the 6 NYCRR Part 360 regulations. The cap section is shown in Figure 4-3 and consists of the following layers:

- 3" impermeable asphalt (1.2×10^{-8} cm/sec) placed in two 1-1/2 inch lifts



6 NYCRR PART 360
LOW PERMEABILITY ASPHALT CAP

FIGURE 4-3

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ALTERNATIVE 2C-CAP SECTION

- 8" asphalt base course
- 13" subbase course (gas venting layer)
- geosynthetic filter fabric
- clean fill placed over the existing landfill cover material to construct a minimum slope of 4 percent
- gas riser vents extending from within the refuse material to 3'-0" above the final ground surface elevation (minimum of one gas riser vent per acre)
- crushed stone backfill around gas venting risers

4.2.4.2 Individual Criteria Asessment

The following paragraphs discuss how Alternative 2C complies with the nine CERCLA evaluation criteria. An evaluation summary for Alternative 2C is provided in Table 4-4.

Overall Protection of Human Health and the Environment

Alternative 2C meets all of the on-site remedial action objectives, which include preventing future contact with on-site surface soils, reducing subsurface gas migration and minimizing future leachate production. Alternative 2C will be protective of human health and the environment since the 2'-0" cap section will eliminate exposure to potentially contaminated on-site surface soils, minimize rainwater infiltration and control subsurface gas migration.

Alternative 2C has an initial cap efficiency of 91.4 percent, which is higher than the 90 percent minimum efficiency stipulated in the ARAR's. Therefore, although leachate production will be significantly reduced by 91.4 percent over existing conditions, some leachate will continue to be generated.

TABLE 4-4

INDIVIDUAL ALTERNATIVE ANALYSIS
ALTERNATIVE NO. 2C - 6 NYCRR PART 360 REGULATIONS
LOW PERMEABILITY ASPHALT CAP

DESCRIPTION

The Alternative 2C cap section consists of a 3" low permeability (1.2×10^{-8} cm/sec) asphalt top course, an 8" asphalt base course, a 13" subbase course/gas venting layer, gas vent risers and sufficient clean fill material to construct a minimum slope of 4 percent to promote stormwater drainage.

INDIVIDUAL CRITERIA ASSESSMENT

Overall Protection of Human Health and the Environment

- Eliminates future exposure to site surface soils.

- Minimizes future subsurface gas migration.

- Minimizes future leachate production.

Compliance with ARAR's

- Complies with New York State 6 NYCRR Part 360 landfill closure regulations.

- Complies with ARAR of 90.0 percent rejection or contaminant of surface precipitation.

- Complies with New York State ambient air quality guidelines, although occasional monitoring of gas emissions may be required.

Long-Term Effectiveness

- Maintains an initial cap efficiency of 91.4 percent.

- Minimizes future subsurface gas migration.

- Eliminates contact with on-site surface soils.

- Proven technology for preventing infiltration.

- Asphalt materials are susceptible to failure due to cracking.

- Annual inspections of the cover system is required.
- Occasional monitoring of gas emissions required.

Reduction of Toxicity, Mobility and Volume

- Not applicable since no treatment is involved.

Short-Term Effectiveness

- Impacts to surrounding community limited to increased vehicular traffic, minor increase in noise levels, fugitive dust emissions. Mitigating measures include restricting vehicular routes, hours of operation, and spraying water for dust control.
- Impacts to on-site workers include fugitive dust emissions, potential exposure to on-site surface soils. Mitigating measures include spraying water for dust control, air monitoring. The use of respiratory protection equipment is not anticipated.
- Anticipated duration of construction is 24 months.

Cost Effectiveness

- Capital Cost: $ 21,225,000
- Annual Maintenance & Monitoring Cost: $ 212,000
- Estimated Present Worth: $ 23,225,000

Community Acceptance

- Alternative 2C is expected to be approved by the local community.

State Acceptance

- Alternative 2C complies with the New York State 6 NYCRR Part 360 landfill closure regulations. However, Alternative 2C review process may take longer than Alternatives 2A and 2B due to the use of an alternative capping material.

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Table 4-4 (Cont'd.)

Implementability

- Technically feasible. Low permeability asphalts are a reliable and frequently used technology for preventing water infiltration in irrigation canals and water storage impoundments.
- Easily implemented. Materials and services are available.
- Administratively feasible. However, the NYSDEC review process for Alternative 2C may be longer than Alternatives Nos. 2A and 2B.

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Alternative 2C will provide similar levels of protection in regard to subsurface gas migration as the other alternatives, since the same gas control technologies will be utilized for all alternatives.

Compliance with ARAR's

Alternative 2C complies with the performance criteria stipulated in the New York State 6 NYCRR Part 360 regulations for landfill closure, although a longer review period may be required due to the use of low permeability asphalt in lieu of clay or a geosynthetic membrane. This alternative will also comply with the New York State ambient air quality guidelines.

Long-Term Effectiveness

Alternative 2C maintains an initial cap efficiency of 91.4 percent which is higher than the 90 percent minimum efficiency stipulated in the ARAR's. This efficiency will significantly reduce reduce the amount of future leachate production at the site.

Alternative 2C will minimize future subsurface gas migration. The proposed passive gas control system will be monitored to ensure its compliance with air quality ARAR's. The system will also be designed so that it is capable of being converted to an active gas collection system should future treatment be required.

Alternative 2C will also eliminate the potential for contact with on-site surface soils.

The Alternative 2C cap section is a reliable means of meeting these remedial action objectives. Low permeability asphalt is a proven technology for limiting infiltration and has been frequently used by the U.S. Bureau of Reclamation to line irrigation canals and water storage impoundments. The impermeable asphalt cap is a reliable barrier which provides a minimum opportunity for failure. The asphalt cap must be regularly maintained since it is susceptible to cracking through freeze and thaw action. Like any asphalt pavement, it may occasionally need resurfacing to ensure its effectiveness. However, since the impermeable layer of the cap section is at the surface, it can be regularly inspected to find cracks or flaws which can be immediately mended. This is an advantage over the other alternatives whose clay or synthetic caps cannot be seen from the surface, allowing cracks or punctures to go unrepaired, thereby causing infiltration and reducing their effectiveness. Annual inspections of the cover system will be required to identify areas in need of repair.

Reduction of Toxicity, Mobility and Volume

The reduction of toxicity, mobility and volume is not applicable since this alternative does not propose any treatment technologies.

Short-Term Effectiveness

It is anticipated that construction activities will not result in emission of hazardous substances which could impact the surrounding communities. The short-term construction related effects include increased vehicular traffic from trucks delivering fill and capping materials, minor increases in noise levels due to construction equipment, fugitive dust emissions, and potential exposure to site surface soils and subsurface gases for construction workers is not anticipated for this alternative. The proposed construction period for Alternative 2C is expected to be 24 months. The actual duration of construction will be effected by the time of year in which it commences, the weather and the availability or source construction materials. This shorter construction period will reduce short-term impacts for this Alternative. In addition, Alternative 2C will require the delivery of more fill material (than Alternatives 2A and 2B) to meet proposed grades, since this alternative will require almost no on-site excavation. Encounters with on-site waste material are not anticipated since the proposed cap depth is 2'-0" which should maintain the minor amounts of excavation within the existing landfill cover material. No excess excavated material will be generated by this alternative.

Short-term impacts can be minimized similar to Alternative 2A and 2B by restricting vehicular routes to non-residential areas, limiting construction operation periods to daytime hours when local residents are at work, spraying construction work areas with water to minimize dust generation and air monitoring in the work zone to prevent exposure to gases in concentrations greater than the Occupational Safety & Health Administration (OSHA) limits.

Cost Effectiveness

The estimated capital cost, annual operation and maintenance cost and present worth cost for Alternative 2C are \$21,225,000, \$212,000 and \$23,225,000, respectively. These costs are sensitive to the availability and costs for clean fill material and low permeability asphalt.

Community Acceptance

It is anticipated that the local community will approve of Alternative 2C.

State Acceptance

Alternative 2C complies with the New York State 6 NYCRR regulations for landfill closure, although a longer review period may be required due to the use of low permeability asphalt in lieu of clay or a geosynthetic membrane.

Implementability

Alternative 2C would be the most easily implemented closure alternative. Impermeable asphalt has been a proven technology for controlling infiltration at irrigation impoundments for approximately 40 years. Although the use of impermeable asphalt is well documented by the U.S. Bureau of Reclamation (Asphalt Institute, 1976) and was a recommended material for construction of landfill liner systems by the USEPA (USEPA, 1980), the use of clay and geosynthetic membrane caps are more commonly used for landfill cover systems. Therefore, this alternative may require a more lengthy NYSDEC approval process than Alternatives 2A and 2B.

4.3 COMPARISON AMONG ALTERNATIVES

This section provides a comparison of how each of the alternatives comply with the nine CERCLA evaluation criteria. A summary of the alternative comparison is listed in Table 4-5.

TABLE 4-5

COMPARATIVE ANALYSIS AMONG ALTERNATIVES

Evaluation Criteria	Alt. No. 1 No Action	Alt. No. 2A - Low Permeability Soil	Alt. No. 2B - Geosynthetic Membrane Cap	Alt. No. 2C - Low Permeability Asphalt Cap
1. Overall Protection of Human Health & the Environment	Not Protective - Does not meet the site's remedial action objectives.	Protective - o Eliminates contact with surface soils o Minimizes gas migration o Minimizes leachate production (total cap efficiency = 99.04%) o Provides minimal risk of cap failure.	Protective - o Eliminates contact with surface soils o Minimizes gas migration o Minimizes leachate production (total cap efficiency = 99.43%) o Provides intermediate risk of cap failure	Protective - o Eliminates contact with surface soil o Minimizes gas migration o Minimizes leachate production (Cap eficiency = 91.4%) o Provides greatest risk of cap failure.
2. Compliance with ARAR's	Does not comply with ARAR's	o Complies with landfill closure regulations o Gas monitoring required to ensure conformance with air quality ARAR's	o Complies with landfill closure regulations o Gas monitoring required to ensure conformance with air quality ARAR's.	o Complies with landfill closure regulations but will require a longer review process prior to approval o Gas monitoring required to ensure conformance with air quality ARAR's.
3. Long-Term Effectiveness	Not Effective	o Eliminates contact with surface soils o Minimizes gas migration o Intermediately effective in reducing leachate production o Minimal potential for cap failure.	o Eliminates contact with surface soils o Minimizes gas migration o Most effective in reducing leachate production o Intermediate potential for cap failure	o Eliminates contact with surface soils o Minimizes gas migration o Least effective in reducing leachate production o Greatest potential for cap failure.
4. Reduction of Toxicity, Mobility & Volume	Not Applicable	Not Applicable	Not Applicable	Not Applicable
5. Short-Term Effectiveness	Not Applicable	o Minimal risk to public o Construction duration: 36 months o On-site air monitoring required o Construction workers may require respiratory protection.	o Minimal risk to public o Construction duration: 30 months o On-site air monitoring required o Construction workers may require respiratory protection.	o Minimal risk to public o Construction duration: 24 months o On-site air monitoring not anticipated o Construction workers not likely to need respiratory protection.
6. Cost Effectiveness				
Capital Cost	$ 0	$30,279,000	$24,070,000	$21,225,000
Annual O&M	$ 115,000	$ 280,000	$ 222,000	$ 212,000
Present Worth	$1,084,000	$32,920,000	$26,158,000	$23,225,000
7. Community Acceptance	Likely Opposed	Likely Accepted	Likely Accepted	Likely Accepted
8. State Acceptance	Not Likely Approved	Likely Approved	Likely Approved	Possibly Approved
9. Implementability	Technically Feasible Not Administratively Feasible Easily Implemented	Technically Feasible Administratively Feasible Easily Implemented	Technically Feasible Administratively Feasible Easily Implemented.	Technically Feasible Administratively Feasible Easily Implemented.

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4.3.1 Overall Protection of Human Health and the Environment

The No Action Alternative is the least protective alternative since it does not meet the remedial action objectives. Each of the closure alternatives provide similar protection in regard to subsurface gas, since similar gas control systems are used for each alternative. The most protective alternative with respect to future leachate production is Alternative 2B, followed, in order, by Alternative 2C and 2A. Alternative 2A provides the minimal potential for failure, followed, in order, by Alternatives 2B and 2C.

4.3.2 Compliance with ARAR's

The No Action Alternative does not comply with the New York State landfill closure ARAR's. All of the landfill closure alternatives will comply with the New York State air quality guidelines and New York State 6 NYCRR Part 360 requirements for subsurface gas control. However, occasional monitoring of the gas control system may be required to ensure compliance with the New York State ambient air quality guidelines. Alternatives 2A and 2B comply directly with the New York State landfill closure regulations. Although Alternative 2C achieves an acceptable cap efficiency, the proposed capping materials utilized in Alternative 2C may require a longer review process prior to NYSDEC approval.

4.3.3 Long-Term Effectiveness

The No Action Alternative is not effective in meeting the remedial action objectives of eliminating contact with on-site surface soils, and minimizing future subsurface gas migration and leachate production. Each of the closure alternatives will be equally effective in eliminating contact with on-site surface soils and minimizing subsurface gas migration. Alternative 2B is the most effective cover system for minimizing leachate production since its geosynthetic barrier and asphalt cover provide an initial efficiency of 99.43 percent. Alternative 2A has an intermediate effectiveness in reducing leachate generation (total cap efficiency = 99.04 percent), while Alternative 2C will be the least effective (cap efficiency = 91.4 percent).

Alternative 2A provides minimal potential for cap failure since the low permeability clay has self sealing properties which minimize failure due to freezing and landfill settlement. Alternative 2B has an intermediate potential for failure both during and after construction due to punctures and tears. Alternative 2C maintains the greatest potential for failure due to freezing and cracking, however, since the capping material is at the surface, cracks can be easily identified and repaired quickly. Alternative 2C will also require periodic resurfacing of the impermeable asphalt cap to insure its integrity. Unlike Alternatives 2A and 2C, the useful life of geosynthetic membranes used in Alternative 2B is unknown and may therefore have to be replaced sometime in the future.

4.3.4 Reduction of Toxicity, Mobility and Volume

This criterion is not applicable to any of the proposed alternatives since no treatment technologies are involved.

4.3.5 Short-Term Effectiveness

This criterion is not applicable to the No Action Alternative since no construction is involved. There are slight differences in short-term effectiveness between the closure alternatives. Alternatives 2A, 2B and 2C all have minor short-term effects on the surrounding community due to increased vehicular traffic; slight increases in noise levels due to construction equipment, and fugitive dust emissions. The existing on-site landfill cover material is reported to vary in depth from 6 inches to 4 feet. Therefore, encounters with on-site waste material for Alternative 2C will be limited to the installation of gas vent piping, since the cap depth for this alternative is only 2'-0". However, Alternatives 2A and 2B may require larger amounts of excavation of on-site waste materials since their cap depths of 3'-0" and 4'-6" are deeper than Alternative 2A, and may therefore warrant the use of air monitoring equipment and possibly the use of protective respiratory equipment during construction activities. The construction periods vary among closure alternatives as follows:

Alternative 2A: 36 months
Alternative 2B: 30 months
Alternative 2C: 24 months

4.3.6 Cost Effectiveness

The estimated capital, annual operation and maintenance and present worth costs are listed in Table 4-5. Although the No Action Alternative has no capital costs, its annual costs will likely increase over the years as leachate production continues. Alternative 2C has the lowest capital and annual costs while Alternative 2A has the highest costs.

Alternative 2A costs are sensitive to the availability and unit prices for clean fill and 1×10^{-7} cm/sec clay. Currently, this clay is not locally available, which accounts for the high costs for Alternative 2A. Alternative 2B is sensitive to the availability and unit prices for clean fill material and geosynthetic membranes. Alternative 2C is sensitive to the availability and unit prices for clean fill and low permeability asphalt.

4.3.7 Community Acceptance

It is anticipated that the local community will oppose the No Action Alternative and accept all of the landfill closure alternatives.

4.3.8 State Acceptance

It is anticipated that the NYSDEC will oppose the No Action Alternative and accept the landfill closure alternatives. However, the NYSDEC review period for Alternative 2C may take longer than Alternatives 2A and 2B since the NYSDEC is more familar with clay and geosynthetic membranes for use in cover systems.

4.3.9 Implementability

The No Action Alternative is technically feasible and easily implemented but is not administratively feasible since it does not comply with the NYSDEC landfill closure regulations. Each of the closure alternatives are technically feasible, easily implemented and administratively feasible. They each utilize services and materials which are readily available.

Alternative 2A utilizes a clay cover system that is a proven and reliable landfill closure technology which is also administratively feasible. Although the majority of the materials and services for Alternative 2A are readily available, $1x10^{-7}$ cm/sec clay is no longer available locally, which increases its costs. Alternative 2B utilizes a geosynthetic membrane cover system which is considered a proven and reliable technology, although its useful life may be uncertain. Alternative 2B is also administratively feasible and utilizes services and materials which are readily available. Alternative 2C is the most easily implemented closure alternative. It is also technically and administratively feasible, and can be implemented with services and materials which are readily available.

4.4 SUMMARY OF DETAILED ANALYSIS

The advantages and disadvantages of each alternative are discussed in the following paragraphs. Table 4-6 summarizes the key tradeoffs among the alternatives.

Alternative No. 1 - No Action

Although the No Action Alternative does not have any capital costs, it does not meet the remedial action objectives for the site and does not comply with the New York State landfill closure regulations. This Alternative is also expected to be opposed by the local community.

Alternative No. 2A - 6 NYCRR Part 360 Regulations - Low Permeability Soil Cap

Alternative No. 2A meets the on-site remedial action objectives of eliminating exposure to site surface soils and minimizing subsurface gas migration and leachate generation. The low permeability soil cover system complies with the current NYSDEC landfill closure regulations. The clay barrier layer provides minimal potential for cap failure among the alternatives, although it is susceptible to frost damage. Cap failure due

TABLE 4-6

KEY TRADEOFFS AMONG ALTERNATIVES

Alternative	Advantages	Disadvantages
Alternative No. 1 - No Action	o No Capital Costs	o Does not meet remedial action objectives o Does not comply with landfill closure regulations o Will be opposed by the local community.
Alternative No. 2A - 6 NYCRR Part 360 - Low Permeability Soil Cap	o Meets Remedial Action Objectives o Complies with landfill closure regulations o Minimal potential for cap failure of alternatives.	o Continued leachate generation (although drastically reduced) o Expected to generate more leachate than Alternative 2B but less than 2C, Based on total cap efficiencies. o Potential for barrier failure due to frost o Higher capital and O&M costs than Alternatives 2B & 2C.
Alternative No. 2B - 6 NYCRR Part 360 - Geosynthetic Membrane Cap	o Meets Remedial Action Objectives o Complies with landfill closure regulations o Maintains highest cap efficiency among alternatives o Expected to generate the least amount of leachate among alternatives based on total cap efficiencies o Intermediate capital & O&M costs among closure alternatives.	o Continued leachate generation (although provides highest level of reduction among alternatives) o Potential for barrier failure due to punctures or tears from improper installation or differential settlement.
Alternative No. 2C - 6 NYCRR Part 360 - Low Permeability Asphalt Cap	o Meets Remedial Action Objectives o Complies with landfill closure regulations o Lowest capital and O&M costs among closure alternatives.	o Continued leachate generation (although drastically reduced) o Maintains lowest total cap efficiency (although still in the acceptable range) o Expected to generate the highest amount of leachate among alternatives based on total cap efficiencies o Potential for barrier failure due to frost o Maximum potential for failure among alternatives.

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to burrowing animals and root penetration is eliminated due to the proposed installation of an asphalt cover over the clay cap. This alternative maintains a total cap efficiency of 99.04 percent, which is slightly lower than Alternative 2B. Alternative 2A has the highest capital and operation and maintenance costs. Although the clay barrier will reduce infiltration by 99.04 percent, a minimal amount of leachate will continue to be produced.

Alternative No. 2B - 6 NYCRR Part 360 Regulations - Geosynthetic Membrane Cap

Alternative 2B meets the remedial action objectives of eliminating exposure to site surface soils and minimizing subsurface gas migration and leachate generation. The geosynthetic membrane cover system compiles with the current NYSDEC landfill closure regulations. This alternative maintains the highest total cap efficiency of 99.43 percent, and the intermediate capital and operation and maintenance costs. The geosynthetic membrane will reduce infiltration by 99.43 percent, which will provide the minimal amount of leachate production among the alternatives. Although the geosynthetic membrane is not susceptible to frost damage, it has a potential for failure due to punctures and tears caused by poor installation practices and differential landfill settlement. Cap failure due to burrowing animals and root penetration is eliminated due to the proposed installation of an asphalt cover over the geosynthetic membrane cap.

Alternative No. 2C - 6 NYCRR Part 360 - Low Permeability Asphalt Cap

Alternative No. 2C meets the remedial action objectives of eliminating exposure to site surface soils and minimizing subsurface gas migration and leachate generation. The low permeability asphalt cover system complies with the current NYSDEC landfill closure regulations, but may require a longer review period due to the use of asphalt in lieu of clay or geosynthetic membranes. This alternative maintains the lowest capital and operation and maintenance costs with the exception of the No Action Alternative. Although the impermeable asphalt barrier may be susceptible to damage from frost and cracking, defects can be quickly identified and remedied since the capping material is at the surface.

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APPENDIX A

TOWN OF OYSTER BAY LETTER
DATED JUNE 11, 1990
REGARDING THE SITE'S ENDANGERMENT ASSESSMENT

DRAFT

TOWN OF OYSTER BAY
DEPARTMENT OF PUBLIC WORKS
150 MILLER PLACE
SYOSSET, NEW YORK 11791-5699

KARL J. LEUPOLD, P.E.
COMMISSIONER

(516) 921-7347

DRAFT

June 11, 1990

Ms. Sherrel Henry
U.S. Environmental Protection Agency
Region II
Jacob K. Javits Federal Building
26 Federal Plaza
New York, New York 10278

Dear Ms. Henry:

RE: SYOSSET LANDFILL ENDANGERMENT ASSESSMENT
CONTRACT NO. DPW 84-352R

Enclosed for your review is a letter from our consultants dated June 7, 1990 prepared in regard to their preliminary comments developed on the Syosset Landfill Endangerment Assessment.

These comments raise several significant issues that cause us to question the conclusions of the Endangerment Assessment. These issues must be resolved as soon as possible.

While we are unable to concur with the findings of the Endangerment Assessment, we have requested our consultants to proceed with the preparation of the On-Site Feasibility Study in our agreed to time frame. The results of our consultants review will be incorporated in the generation of the On-Site Feasibility Study. As you are aware, the Town is committed to remediating the Syosset Landfill in such a manner that is consistent with applicable legal requirements and potential end uses for the property, which include highway yard operations, materials storage, composting and parking. It is our concern that the Endangerment Assessment, as presented may hinder the remediation process by identifying nonexistent risks.

Should you have any questions regarding these comments, please contact our Project Manager, Richard W. Lenz, P.E.

Very truly yours,

KARL J. LEUPOLD, P.E.
COMMISSIONER/PUBLIC WORKS /fms

KJL/RWL/ew
cc: Robert LoPresti, Director of Legislative Affairs
Anthony Maurino, Esq., Deputy Commissioner/Env. Ctl.
John Paider, Esq., Sr. Deputy Town Attorney
Peter Paden, Esq., Teitelbaum & Hiller
Andy Barber, Geraghty & Miller, Inc.
✓John Lekstutis, Lockwood, Kessler & Bartlett, Inc.

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LOCKWOOD, KESSLER & BARTLETT, INC.

CONSULTING ENGINEERS SINCE 1889

100 years

ONE AERIAL WAY, SYOSSET, NEW YORK 11791 (516) 938-0600

TELEFAX (516) 931-6344

June 7, 1990
LKB #4087-07

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Karl J. Leupold, P.E.
Commissioner of Public Works
Town of Oyster Bay
150 Miller Place
Syosset, New York 11791

Attention: James M. Byrne, P.E.
Deputy Commissioner of Engineering

Subject: Syosset Landfill Endangerment Assessment
Contract No. DPW 84-352R

Gentlemen:

As requested, Lockwood, Kessler & Bartlett, Inc. and Geraghty & Miller, Inc. have completed a preliminary review of the Syosset Landfill Endangerment Assessment, prepared by Versar, Inc., dated April 12, 1990.

The Endangerment Assessment concludes that the site presents a potential threat to human health. This conclusion is based on a risk assessment model whose computations result in a hazard index greater than 1, caused by the potential for ingestion of arsenic through groundwater consumption; and a cumulative upper bound risk for all carcinogens, caused by the potential for inhalation of VOC gases that is greater than the acceptable range of carcinogenic risk (1E-04 to 1E-07). Our review of the document indicates that these conclusions are inaccurate and inappropriate.

We have found a substantial error in the calculations which were used to derive the cumulative upper bound risk for all carcinogens which, when corrected, substantially reduces the resulting risk number to a value well within the acceptable risk range. In addition, we have identified a series of assumptions which are inappropriate and which result in an artificially high hazard index.

Specifically, the calculations which were used to convert the VOC soil gas concentrations reported in the Remedial Investigation to the units used in the risk assessment are in error. This error substantially affects the emission rates and ambient concentrations presented in Tables 3-5 and 3-7 of the Endangerment Assessment. We have corrected these tables and attach same for your review. Since the emission rate and ambient concentrations are drastically reduced when correctly calculated, the risks associated with this pathway will also be drastically reduced. The following table compares the total cancer risk values determined by Versar with the values calculated using the corrected emission rate and ambient concentration values.

	Versar EA Report Risk Values		Revised Risk Values	
Cancer Risk	Inhalation only	Total Inhalation & Oral	Inhalation Only	Total Inhalation & Oral
Adult	1.97E-04	2.32E-04	3E-07	1E-05
Children	6.28E-05	8.67E-05	1E-06	3E-05

With regard to the subchronic hazard index for children for oral exposure, which was calculated to be 2.61 (greater than the acceptable level of 1), we wish to point out several assumptions in the risk model that are incorrect, as follows:

1. The risk model identifies well N-4133 as the closest groundwater withdrawal point (within 1,000' of the Landfill). This assumption is incorrect. Well N-4133 no longer exists - (it has been cut off below grade and sealed with concrete). Therefore, it cannot be used or considered as the closest withdrawal point. The closest downgradient groundwater withdrawal point for potential ingestion of arsenic is located approximately two miles from the landfill site. This is considerably more than the 1,000' used in the risk model.

2. The risk model uses arsenic concentrations for unfiltered water samples. These concentrations are substantially higher than the measured values for the filtered samples that are representative of water provided through supply wells. Furthermore, the maximum value used (180 ppb) was not a recurring value and does not represent realistic conditions at the site.

3. The risk assessment uses a transport model that was neither calibrated nor checked with actual off-site data. Furthermore, it assumed no attenuation and, as such, results in an unrealistically high value for off-site arsenic concentration. Since an off-site remedial investigation is planned to determine off-site groundwater conditions, use of the transport model, at this time, is inappropriate and in conflict with the proposed work plan.

4. Finally, the risk assessment considered all wells within a one-mile radius of the site to be potentially affected because of variation in flow direction, temporarily or under pumping conditions. This assumption is in direct conflict with the remedial investigation report, which clearly identified the horizontal and vertical components of groundwater flow.

In summary, the risk model makes assumptions which are inaccurate and erroneously result in an artificially high subchronic hazard index. With a set of correct assumptions, the hazard index will be reduced to a value well below one (1).

The errors described above are significant and substantially affect the conclusions of the Endangerment Assessment. It presents an unrealistic and incorrect assessment of the potential health risks associated with the site. As such, we do not believe the use of these results in the development of the On-Site Feasibility Study is appropriate and believe the Endangerment Assessment should be withdrawn. In addition, we believe the identification of potential off-site risk pathways is premature and should await the results of the Off-Site Remedial Investigation/Feasibility Study, which will be undertaken by the Town.

As you requested, we are continuing to prepare the On-Site Feasibility Study for the Syosset Landfill. We expect to complete this study in mid June, 1990, which is within the time schedule that was agreed upon earlier. Should you have any questions regarding the Endangerment Assessment or its analysis, please do not hesitate to contact our office.

Very truly yours,

LOCKWOOD, KESSLER & BARTLETT, INC.

John P. Lekstutis, P.E.
Vice President

JPL/dm

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LOCKWOOD, KESSLER & BARTLETT, INC.

Table 3-5

REVISED SOIL GAS DATA

Compound	Soil Gas Concentration* Max. (g/cm^3)	Site Area (cm^2)	Emission Rate Max. (g/sec)
Benzene	5.74E-10	1.85E+09	1.7E-03
Chloroform	5.84E-11	1.85E+09	2.0E-04
Methylene Chloride	6.26E-10	1.85E+09	1.9E-03
Tetrachloroethylene	8.15E-11	1.85E+09	2.0E-04
Toluene	9.03E-10	1.85E+09	2.7E-03
Vinyl Chloride	1.02E-09	1.85E+09	3.1E-03

* Correctly Converted Soil Gas Concentrations

The concentrations reported in the Endangerment Assessment report were incorrectly converted from the Remedial Investigation units (ppb) to the Endangerment Assessment units (ug/l) in Table 1-4 of the Endangerment Assessment. Although a direct conversion from ppb to ug/l is correct in water, it is not a correct conversion in air. The correct conversion in air must include the molecular weight of the substance and a unitless conversion constant for temperature and pressure (24.45). The correct equation, as reported by the American Conference of Governmental Industrial Hygienists is:

$$\text{Concentration in } ug/m^3 = \frac{\text{Concentration in ppb} \times \text{Gram Molecular Weight of the Substance}}{24.45}$$

Utilizing this equation and applying an additional conversion from ug/m^3 to g/cm^3, the soil gas concentrations were correctly converted to the values in the revised Table 3-5 above.

Table 3-7

REVISED AMBIENT AIR CONCENTRATIONS AT RECEPTORS

a) 10 Meters from Source

	Emission Rate Max (ug/sec)	Box Width W(m)	Wind Speed u (m/sec)	Box Height H(m)	Ambient Concen. C max (ug/m ^{3})
Benzene	1.7E+03	300	1.45	1.4	2.79
Chloroform	2.0E+02	300	1.45	1.4	0.33
Methylene Chloride	1.9E+03	300	1.45	1.4	3.12
Tetrachloro- ethylene	2.7E+02	300	1.45	1.4	0.33
Toluene	2.7E+03	300	1.45	1.4	4.43
Vinyl Chloride	3.1E+03	300	1.45	1.4	5.09

b) 50 Meters from Source

	Emission Rate Max (ug/sec)	Box Width W(m)	Wind Speed u (m/sec)	Box Height H(m)	Ambient Concen. C max (ug/m ^{3})
Benzene	1.7E+03	300	2.60	3.8	0.57
Chloroform	2.0E+02	300	2.60	3.8	0.07
Methylene Chloride	1.9E+03	300	2.60	3.8	0.64
Tetrachloro- ethylene	2.0E+02	300	2.60	3.8	0.07
Toluene	2.7E+03	300	2.60	3.8	0.91
Vinyl Chloride	3.1E+03	300	2.60	3.8	1.05

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APPENDIX B

POTENTIAL ARAR'S

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SUMMARY OF CODE REVISION

STANDARDS

General MCLs

The New York State Department of Health has adopted standards to limit organic chemical contamination of public drinking water supplies. The code revision (to Part 5 of the State Sanitary Code) establishes maximum contaminant levels (MCLs) or standards for:

Principal Organic Contaminant (POC) - 0.005 mg/l (5 ug/l)
Unspecified Organic Contaminant (UOC) - 0.050 mg/l (50 ug/l)
Total of POCs and UOCs - 0.10 mg/l (100 ug/l)

POCs would be defined as any organic chemical belonging to any of six general chemicals classes:

Halogenated Alkanes
Halogenated Ethers
Halobenzenes and Substituted Halobenzenes
Benzene and Alkyl- or Nitrogen-Substituted Benzenes
Substituted, Unsaturated Aliphatic Hydrocarbons
Halogenated Non-aromatic Cyclic Hydrocarbons

POCs, by definition, exclude trihalomethanes and other organic chemicals with a specific MCL of their own.

UOCs would be defined as any organic chemical not covered by another MCL.

The Department recognizes the possible need for exceptions from the proposed MCLs for POCs and UOCs if the presence of a specific organic chemical does not represent contamination and sufficient, valid scientific information demonstrates that they do not pose an unreasonable risk to human health. When justified, the regulation contains provisions to allow for the establishment of a more lenient (higher) MCL.

The regulation also allows a water supplier to submit justification for a higher MCL for up to 60 days following application of a paint or lining to a potable water appurtenance. The Commissioner may allow the higher MCL if he determines that no unreasonable risk to human health would result.

The Department recognizes the need to use a stricter (lower) interim guideline value for a contaminant which lacks a chemical-specific MCL but for which the available toxicological data are judged sufficient to warrant more stringent control. The regulation allows for consideration of lower interim guidelines when justified. The Department believes that, from a public health perspective, the benefits associated with the broad nature of the general MCLs, outweigh the fact that interim guidelines may have to be used in some cases. For example, the existing guidelines for PCBs - 1 ug/l; aldicarb - 7 ug/l; carbofuran - 15 ug/l; atrazine - 25 ug/l will be retained until a specific MCL for each chemical is developed.

Individual MCLs

The code revision includes a specific MCL of 0.002 mg/l (2 ug/l) for vinyl chloride and lowers the existing MCLs for two organic chemicals. The revised MCLs are 0.050 mg/l (50 ug/l) for both methoxychlor and 2,4-D.

Implementation Dates

The effective date of the MCLs in this code revision is January 9, 1989. Monitoring and other requirements are effective as of publication in the State Register.

MONITORING

Contaminants

The code revision requires monitoring for certain organic chemicals and allows State discretion to require monitoring of other organic chemicals when the State believes that contaminants have been or may be present in concentrations which exceed the MCL. All community water systems are required to monitor for the 52 POCs listed on Table 1 and for vinyl chloride. The code uses the same nomenclature of the Environmental Laboratory Approval Program, so chemical names used previously in the proposal are listed in parentheses on Table 1.

The monitoring requirement also extends to noncommunity systems that regularly serve at least 25 of the same persons, four hours or more per day, for four or more days per week, for 26 or more weeks per year. These systems are called nontransient, noncommunity water systems.

The contaminants must be analyzed by EPA methods 502.2, 524.1, 524.2 or a combination of 502.1 and 503.1. The analysis must be capable of detecting the contaminants as low as 0.0005 mg/l (0.5 ug/l). All systems that serve 150 or more service connections from groundwater sources also must analyze at least one sample from each source for 1,2-dibromoethane (EDB) and 1,2-dibromo-3-chloropropane (DBCP). EPA Method 504, with a detection level of 0.00002 mg/l (0.02 ug/l), must be used for EDB and DBCP.

Since POCs are defined by the chemical class above, the standard applies to many more chemicals than those listed on Table 1. The regulations allow the State to require monitoring for other contaminants (POCs or UOCs) when the State believes they might exceed the MCL or present a risk to public health.

Location of Sample Collection

The regulations require each source to be sampled at specific locations dictated by ground or surface sources. The location of sampling for each groundwater source is at or before the first service connection and prior to mixing with other sources. The regulations allow the State to specify another location. This provision can be used to require monitoring following treatment to remove organics or to accept certain sources as representative of other nearby sources in the same aquifer under certain conditions at State discretion.

The regulations require systems with surface sources to sample at points in the distribution system representative of each source or at entry point or points to the distribution systems after any treatment plant.

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Initial Sampling

The initial monitoring requirement for each source depends on the type and size of the system as scheduled below:

System Type/Size	Required Samples per source
Community serving 10,000 or more persons	One per quarter for one year by 12/31/88
Community serving 3,300-9,999 persons	One per quarter for one year by 12/31/89
Community serving fewer than 3,300 persons and more than 149 service connections	One per quarter for one year by 12/31/90
Community serving fewer than 150 service connections	One by 6/30/91
Nontransient, Noncommunity	One by 6/30/92
Noncommunity	State Discretion

Systems serving over 10,000 persons were notified by mail in October 1987 to perform the required sampling under existing Code, Section 5-1.75, and EPA regulations.

As with other contaminants, the State may use Section 5-1.51(e) to require a system to monitor sooner or more frequently whenever the potential exists for an MCL violation. Consequently, systems with sources that have been shown by previous monitoring to be contaminated may be required to monitor before the above schedule.

Vulnerability to Contamination

The State will assess the vulnerability to contamination of all sources of water supply based on:

a. previous monitoring results

b. number of persons served by the public water system

c. proximity of the system to a larger system

d. proximity to commercial or industrial use, disposal or storage of volatile synthetic organic chemicals; and

e. the degree of protection afforded the source of water supply.

Detailed guidance in determining vulnerability will be developed similar to EPA's as presented in the Federal Register, November 13, 1985, Volume 50, No. 219.

For systems serving fewer than 150 service connections, more than one sample will be required for those sources that are determined to be vulnerable. Following a determination of nonvulnerability, the State may reduce initial and some of the repeat sampling described below for intermediate sized systems (more than 150 service connections, but population less than 3,300 persons). It is unlikely that systems serving 3,300 or more persons would have monitoring reduced since EPA's guidance considers all systems this large to be vulnerable to contamination. Statewide surveys show that volatile organic chemicals are more than twice as likely to be found in sources of these larger systems.

Repeat Monitoring

At those sources where contaminants are detected, (at 0.0005 mg/l or above) monitoring would be required to continue on quarterly intervals. Systems with 150 or more service connections for which contaminants are not detected would be required to repeat monitoring every three years. Systems with fewer than 150 service connections would not be required to repeat monitoring unless they are determined to be vulnerable.

DETERMINATION OF COMPLIANCE

If the results of a sample exceed the MCLs, the supplier of water would be required to collect one to three confirmation samples as soon as practical but no later than 30 days. If the average of all samples (monitoring sample plus confirmation sample(s)) exceeds the MCL, a MCL violation occurs. Those systems with sources that exceed the MCLs after the effective date will be put on a compliance schedule and required to provide public notification. Both short and long-term compliance strategies will be developed. The long-term strategy in most cases, would be to develop alternative sources or provide treatment. Potential short-term strategies include an alternative water source, minimal use of a contaminated source, such as stand-by for peak demand, conservation measures, temporary treatment, and consumer advisories.

Persistent violators of MCLs, or monitoring and reporting requirements will be subject to enforcement actions as for other contaminants regulated in the code.

NOTIFICATION

The supplier of water must make State, consumer and public notification for MCL or other violations according to requirements similar to those existing for other contaminants.

The regulations also require systems to notify its consumers as to the availability of monitoring results for volatile organic chemicals. Notification will be included in the first set of water bills issued by the system after the receipt of the result or by other written notice within three months. The State would accept as written notice, a one-time publication in a daily newspaper of general circulation in the area served by your system. The notice should:

1. identify a person and supply the telephone number to contact for information on the monitoring results, and
2. where appropriate, state that quarterly monitoring will continue for the remainder of the year.

A legal notice is acceptable provided it is conspicuous and does not contain unduly technical language, unduly small print or similar problems that frustrate the purpose of the notice.

TABLE 1
ORGANIC CHEMICALS IN REQUIRED MONITORING
VINYL CHLORIDE AND 52 PRINCIPAL ORGANIC CONTAMINANTS
(AS PER ENVIRONMENTAL LABORATORY APPROVAL PROGRAM)

CHEMICAL NAME ELAP NOMENCLATURE	CHEMICAL NAME USED PREVIOUSLY IN PROPOSAL
benzene	
bromobenzene	
bromochloromethane	
bromomethane	
n-butylbenzene	
sec-butylbenzene	
tert-butylbenzene	
carbon tetrachloride	
chlorobenzene	
chloroethane	
chloromethane	
2-chlorotoluene	(o-chlorotoluene)
4-chlorotoluene	(p-chlorotoluene)
dibromomethane	
1,2-dichlorobenzene	(o-dichlorobenzene)
1,3-dichlorobenzene	(m-dichlorobenzene)
1,4-dichlorobenzene	(p-dichlorobenzene)
dichlorodifluoromethane	
1,1-dichloroethane	
1,2-dichloroethane	
1,1-dichloroethene	(1,1-dichloroethylene)
cis-1,2-dichloroethene	(cis-1,2-dichloroethylene)
trans-1,2-dichloroethene	(trans-1,2-dichloroethylene)
1,2-dichloropropane	
1,3-dichloropropane	
2,2-dichloropropane	
1,1-dichloropropene	
cis-1,3-dichloropropene	
trans-1,3-dichloropropene	
ethylbenzene	
hexachlorobutadiene	
isopropylbenzene	
p-isopropyltoluene	(p-cymene)
methylene chloride	(dichloromethane)
n-propylbenzene	
styrene	
1,1,1,2-tetrachloroethane	
1,1,2,2-tetrachloroethane	
tetrachloroethene	(1,1,2,2-tetrachloroethylene)
toluene	
1,2,3-trichlorobenzene	
1,2,4-trichlorobenzene	
1,1,1-trichloroethane	
1,1,2-trichloroethane	
trichloroethene	(1,1,2-trichloroethylene)
trichlorofluoromethane	(fluorotrichloromethane)
1,2,3-trichloropropane	
1,2,4-trimethylbenzene	
1,3,5-trimethylbenzene	
m-xylene	
o-xylene	
p-xylene	

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TABLE 2
POTENTIAL GROUND-WATER ARARs (AND TBCs) FOR SYOSSET LANDFILL

	NYSDEC Ground Water Standards (Class GA) (UG/L) (A)	NIPDWR (UG/L) (B)	SDWA MCLG (UG/L) (C)	SDWA MCL (UG/L) (D)	SDWA SMCL (UG/L) (E)	RCRA MCLS (UG/L) (F)	HEALTH BASED CRITERIA: CARCINOGENS (MG/KG) (G)	HEALTH BASED CRITERIA: SYSTEMATIC TOXICANTS (MG/KG) (H)
Volatile organic compounds								
1,1-Dichloroethane	50(G)	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	10	NA	0	5	NA	NA	MCL	NA
Tetrachloroethene	.7(G)	NA	0	5	NA	NA	6.9	400
Chlorobenzene	NA	NA	NA	NA	NA	NA	NA	1000
Benzene	ND	NA	0	5	NA	NA	MCL	NA
Toluene	50(G)	NA	2000	2000	40	NA	NA	1000
Semivolatile organic compounds								
1,4-Dichlorobenzene	NA	NA	75	75	5	NA	NA	NA
1,2-Dichlorobenzene	NA	NA	600	600	10	NA	NA	NA
Benzoic Acid	NA	NA	NA	NA	NA	NA	NA	NA
N-nitrosodiphenylamine	NA	NA	NA	NA	NA	NA	NA	NA
Fluoranthene	NA	NA	NA	NA	NA	NA	NA	NA
Butylbenzylphthalate	50(G)	NA	NA	NA	NA	NA	NA	NA
bis(2-Ethylhexyl)phthalate	4200	NA	NA	NA	NA	NA	NA	700
Di-N-octylphthalate	50(G)	NA	NA	NA	NA	NA	NA	NA
Target analyte list								
Antimony	NA	NA	NA	NA	NA	NA	NA	10
Arsenic	25	50	0	50	NA	50	MCL	NA
Chromium (T)	50	50	100	100	NA	50	MCL	MCL
Copper	1000	NA	NA	NA	100	NA	NA	NA
Zinc	5000	NA	NA	NA	5000	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA	NA	NA
Barium	1000	1000	5000	1000	NA	1000	NA	MCL
Iron	300	NA	NA	NA	300	NA	NA	NA

NA - Not available.
(A) - New York State Department of Environmental Conservation. Ground water Quality Regulation 6 NYCRR Part 703.
(B) - National Interim Primary Drinking Water Regulation (NIPDWR). Interim enforceable drinking water regulations first established under the Safe Drinking Water Act (SDWA) that are protective of public health to the extent feasible.
(C) - SDWA Maximum Concentration Limits (MCLs) adopted as enforceable standards for public drinking water systems (40 CFR 141.11-141.16).
(D) - SDWA MCL Goals (MCLGs) are nonenforceable health goals for public water systems (40CFR 141.50 - 141.51 and 50CFR 46936).
(E) - SDWA secondary MCLs (SMCLs) based on taste and odor detection limits.
(F) - RCRA MCLs have been adopted as part of RCRA ground-water protection standards (40 CFR 264.94).
(G) - Guidance value. → Guideline ←
(H) - Health -Based Criteria for Carcinogens, Oral Exposure Route. Table 8-6 of Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations.
(I) - Health -Based Criteria for Systemic Toxicants. Table 8-7 of Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations.

TABLE 3
POTENTIAL SOIL TBCs FOR SYOSSET LANDFILL

	HEALTH BASED CRITERIA		
	CARCINOGENS (A) (mg/kg)	SYSTEMATIC TOXICANTS (B) (mg/kg)	AVERAGE CONCENTRATIONS (C) (mg/kg)
Volatile organic compounds			
Acetone	NA	8,000	NA
Carbon disulfide	NA	8,000	NA
MethylENE Chloride	93	70	NA
Chloroform	110	800	NA
Tetrachloroethene	140	800	NA
Chlorobenzene	NA	2,000	NA
2-Butanone	NA	NA	NA
Ethylbenzene	NA	8,000	NA
Total Xylenes	NA	200,000	NA
Semivolatile organic compounds			
Naphthalene	NA	NA	NA
Diethylphthalate	NA	60,000	NA
Flourene	NA	NA	NA
Phenanthrene	NA	NA	NA
Anthracene	NA	NA	NA
Di-n-butylphthalate	NA	8,000	NA
Fluoranthene	NA	NA	NA
Pyrene	NA	NA	NA
Benzo(a)anthracene	0.224	NA	NA
bis(2-Ethylhexyl)phthalate	NA	2,000	NA
Chrysene	NA	NA	NA
Di-n-octylphthalate	NA	NA	NA
Benzo(b)fluoranthene	NA	NA	NA
Benzo(a)pyrene	0.0609	NA	NA
Indeno(1,2,3-cd)pyrene	NA	NA	NA
Target analyte list			
Aluminum	NA	NA	71000
Arsenic	NA	NA	5
Calcium	NA	NA	NA
Chromium (III)	NA	8,000	100
Chromium (VI)	NA	400	NA
Copper	NA	NA	30
Magnesium	NA	NA	5000
Manganese	NA	NA	600
Zinc	NA	NA	50
Potassium	NA	NA	NA
Barium	NA	4,000	430
Iron	NA	NA	NA
PCBs			
Aroclor-1016	0.091	NA	NA
Aroclor-1254	0.091	NA	NA

(A) - Health-Based Criteria for Carcinogens, Oral Exposure Route
Table 8-6 of Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations.
EPA 530/SW-89-031, May 1989.

(B) - Health-Based Criteria for Systemic Toxicants
Table 8-7 of Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations.
EPA 530/SW-89-031, May 1989.

(C) - SW 874 Hazardous Waste Land Treatment (Lindsay, 1979).

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APPENDIX C

COST ANALYSES

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SYOSSET LANDFILL
ALTERNATIVE 2A - 6 NYCRR PART 360 REGULATIONS
LOW PERMEABILITY SOIL CAP

COST ANALYSIS

ITEM	PRESENT WORTH COST
1. SITE PREPARATION - Demolition, removals, renovations	$ 345,000
2. SITE WORK - Drainage structures & piping, recharge basin expansion, landscaping, etc.	$ 3,387,000
3. GAS VENTING SYSTEM - gas vent risers, interconnecting piping & crushed stone backfill	$ 135,000
4. CAP SECTION:	$ 15,246,000

Excavation	65,500 CY	@$ 3.00/CY =	$ 196,500
Clean Fill	105,400 CY	@ 25.00/CY =	2,635,000
Filter Fabric	338,825 CY	@ 4.25/SY =	1,440,000
Gas Venting Layer	64,955 CY	@ 34.00/CY =	2,208,500
Clay (1x10 $^{-7}$ cm/s)	97,400 CY	@ 90.00/CY =	8,776,000
			$15,246,000

5. ASPHALT PAVEMENT COURSES - 3" Top Course, 8" Base Course, 12" Subbase Course	$ 5,110,000
SUB-TOTAL CAPITAL COSTS	$ 24,223,000
CONTINGENCIES (@25%) - Engineering Administration, Legal Fees & Related Contingencies	$ 6,056,000
TOTAL CAPITAL COSTS	$ 30,279,000
PRESENT WORTH ANNUAL O&M COSTS ($280,000/year - cap repair and maintenance)	$ 2,641,000
TOTAL PRESENT WORTH COSTS	**$ 32,920,000**

NOTE
1. The expected accuracy of Feasibility Study Cost Analyses is +50 percent to - 30 percent (USEPA, 1988a).
2. The cost analysis for this alternative is sensitive to the current costs for 1x10 $^{-7}$ cm/sec clay, clean fill and asphalt.

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SYOSSET LANDFILL
ALTERNATIVE 2B - 6 NYCRR PART 360 REGULATIONS
GEOSYNTHETIC MEMBRANE CAP

COST ANALYSIS

ITEM	PRESENT WORTH COST
1. SITE PREPARATION - Demolition, removals, renovations	$ 345,000
2. SITE WORK - Drainage structures & piping, recharge basin expansion, landscaping, etc.	$ 3,387,000
3. GAS VENTING SYSTEM - gas vent risers, interconnecting piping & crushed stone backfill	$ 135,000
4. CAP SECTION:	$10,280,000

Excavation	29,835 CY	@$ 3.00/CY	=	89,500
Clean Fill	202,380 CY	@ 25.00/CY	=	5,059,500
Filter Fabric	508,235 SY	@ 4.25/SY	=	2,160,000
Gas Venting Layer	64,955 CY	@ 34.00/CY	=	2,208,500
Geosynthetic Membrane	169,455 SY	@ 4.50/SY	=	762,500
				$10,280,000

ITEM	PRESENT WORTH COST
5. ASPHALT PAVEMENT COURSES - 3" Top Course, 8" Base Course, 12" Subbase Course	$ 5,110,000
SUB-TOTAL CAPITAL COSTS	$19,257,000
CONTINGENCIES (@25%) - Engineering Administration, Legal Fees & Related Contingencies	$ 4,813,000
TOTAL CAPITAL COSTS	$24,070,000
PRESENT WORTH ANNUAL O&M COSTS ($222,000/year - cap repair and maintenance)	$ 2,088,000
TOTAL PRESENT WORTH COSTS	**$26,158,000**

NOTE

1. The expected accuracy of Feasibility Study Cost Analyses is +50 percent to - 30 percent (USEPA, 1988a).
2. The cost analysis for this alternative is sensitive to the current costs for geosynthetic membranes, clean fill and asphalt.

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SYOSSET LANDFILL
ALTERNATIVE 2C - 6 NYCRR PART 360 REGULATIONS
LOW PERMEABILITY ASPHALT CAP

COST ANALYSIS

ITEM	PRESENT WORTH COST
1. SITE PREPARATION - Demolition, removals, renovations	$ 345,000
2. SITE WORK - Drainage structures & piping, recharge basin expansion, landscaping, etc.	$ 3,387,000
3. GAS VENTING SYSTEM - gas vent risers, interconnecting piping & crushed stone backfill	$ 135,000
4. CAP SECTION:	$ 13,113,000

Excavation	13,500 CY	@ 3.00/CY =	$ 40,500	
Clean Fill	271,780 CY	@ 25.00/CY =	6,794,500	
Filter Fabric	169,410 SY	@ 4.25/SY =	720,000	
Gas Venting Layer (Subbase Course)	70,350 CY	@ 34.00/SY =	2,392,000	
Asphalt Base Course	37,650 CY	@ 26.60/CY =	1,001,500	
Asphalt Top Course	28,600 TON	@ 75.70/TON =	2,165,000	
			$13,113,000	

SUB-TOTAL CAPITAL COSTS	$ 16,980,000
CONTINGENCIES (@25%) - Engineering Administration, Legal Fees & Related Contingencies	$ 4,245,000
TOTAL CAPITAL COSTS	$ 21,225,000
PRESENT WORTH ANNUAL O&M COSTS ($212,000/year - cap repair and maintenance)	$ 2,000,000
TOTAL PRESENT WORTH COSTS	**$ 23,225,000**

NOTE
1. The expected accuracy of Feasibility Study Cost Analyses is +50 percent to - 30 percent (USEPA, 1988a).
2. The cost analysis for this alternative is sensitive to the current costs for low permeability asphalt and clean fill.